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FLIGHT and The AIRCRAFT ENGINEER

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The Outlook

Thorny Questions

TWO articles in this issue focus attention once more upon the subject of post-war commercial aviation. In one a plea is put forward for recognition of the claims of the flying boat in formulating our future policy, and in the other, the merits of a certain airport, Gatwick to wit, as one of London's airports are extolled.

The two articles pose, the one directly and the other indirectly, the question : landplane or seaplane ? If the former, then vast areas of land will be needed for airports with their runways, buildings, road and railway communications. If the latter, then special docks for flying boats come into the picture, for it is scarcely conceivable that more than a very few of our existing harbours, cluttered up as they are with surface shipping, could be made suitable for flying-boat bases.

We on *Flight* have always been great believers in the merits of the flying boat. The fact that the British Empire is scattered over the globe, its constituent parts separated by leagues of ocean, would appear to point logically to marine aircraft. The article published this week indicates that the flying boat, particularly the very large one of the future, need not necessarily be much inferior to the landplane of comparable size.

No one would argue that the flying boat is the most suitable type of aircraft for all routes. That would be absurd. But we do join forces with Saunders-Roe in pleading that it should not be left out of our programme for the future.

Shipping and the Air

APART from such fundamental questions as free competition or one "chosen instrument," to which no official answer has yet been given, there is the definition of the place which shipping should occupy in post-war British commercial aviation. There is little purpose in talking vaguely in general terms. The most important air route after the war will be the Atlantic, so that may well be taken as a suitable subject for examination. When, some months ago, sixteen American domestic air lines submitted a declaration of policy to the Civil Aeronautics Board, United Air Lines suggested a proviso about possible pooling and co-operation. This was turned down, and United refused to sign the declaration. Its president, Mr. W. A. Patterson, expressed the views of United Air Lines in a separate report.

Mr. Paterson, whose very sane views on the subject of air freight we published on May 20th, 1943, points out that Great Britain, Canada, France, Germany and Russia have Government-owned operating companies, while Holland and Sweden have Government-controlled companies. He then quotes passenger figures (seaborne) for 1930, a typical year between the wars, which show that there were 214,685 westbound and 183,547 eastbound sea passengers that year. He further shows that the traffic was highly seasonal, a fact which has a marked bearing on the economics of route operation. Taking domestic experience as a guide, Mr. Patterson visualises that by 1948 80 per cent. of the passenger travel across the Atlantic may be by air. That would give 171,748 westbound and 146,838 eastbound Atlantic passengers.

On the assumption that for optimum economy the aircraft types used should have a range of 3,500 miles while carrying 100 passengers, plus 5,000 lb. of mail and cargo, Mr. Patterson points out, 15 such aircraft would handle the market in 1944 and 43 aircraft in 1948. If the transatlantic traffic were to be divided equally between seven countries, each would only have six aircraft, and if that number had to be divided between

several companies in each country, the organisations would become too small to be economic.

"A review of such figures," Mr. Patterson states, "leads us to the conclusion that neither individual air lines now in the domestic field nor individual steamship companies can expect to extend their present operations into transocean air service without destructive results." He regards pooling as the only answer, but thinks that both airline interests and steamship companies should participate. The alternative would be subsidies which would waste money on encouraging waste and inefficiency.

Although Mr. Patterson views the problems from the American angle, the fundamental principles involved are not very different in this country. The answer appears to be not one but several "chosen instruments," which might well include a few pooled air and shipping interests.

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The Fall of Leros

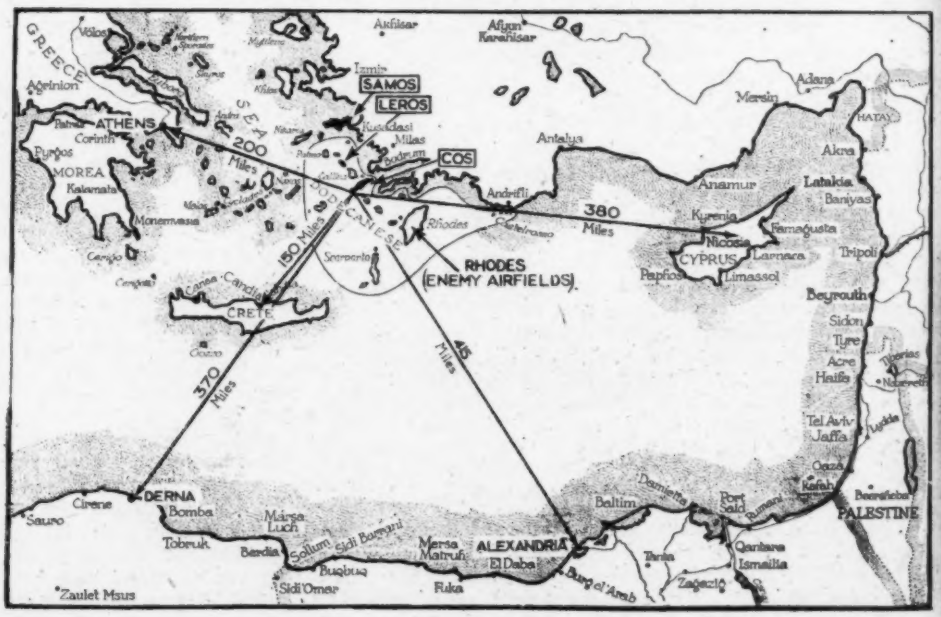
THE surrender of the gallant garrison of Leros, following on the loss of Cos, is one more example of what must happen in modern war when one side has sufficient air power at its command and the other is inadequately provided in this major arm of war. The key points to occupation of the Dodecanese are the airfields on the islands of Rhodes and Cos, though those in Crete and on the mainland of Greece are also able to intervene. Leros has no airfield.

Rhodes was seized by the Germans soon after the surrender of Italy, and the British attempt to hold Cos was a failure. That failure spelt the doom of the British troops in Leros, which were bombed into surrender. The attempts of bombers from both the Middle East and the N.W. Africa Air Forces to put the enemy's bomber bases out of action were not successful. This war has shown that such attempts to sterilise air bases by bombing are sometimes successful and sometimes quite ineffective. One can only count with assurance on success when the attacks are very heavy and concentrated.

The Navy broke up some German expeditions to reach the Dodecanese, but was hampered in its efforts by German local superiority in the air. One is inclined to ask where were all the carriers which took part in the Salerno landing. They may be reserved for another landing behind Kesselring's lines. There may be too great a risk of U-boats for them to venture among the Ægean islands. But they could surely have lain between Egypt and the Dodecanese and kept fighters in action over the latter.

When naval aircraft cannot take part, the onus rests on the R.A.F., and the A.O.C.-in-C. is in the position of having to fulfil the requirements of both the N.W. Africa forces and also of the Army of the Middle East. General Maitland Wilson has stated that the German efforts to retake Leros embarassed them elsewhere; but Stukas are not much used elsewhere, and they played the main part in beating down the British defence. A mistake has clearly been made in the Ægean, which is a concern of the Army of the Middle East, and it failed, so it seems, simply because sufficient fighter strength could not be concentrated on Antimachia airfield in Cos—sufficient, that is to say, to drive off the German bombers from Rhodes and elsewhere.

The question is, was the air side of the Dodecanese operations not thrashed out thoroughly by the staff at Cairo; and if not, why not?



SHALL WE NEVER LEARN? The mileages shown on this map of the Eastern Mediterranean show clearly why no fighter cover could be put over the lost Dodecanese islands and, therefore, why their loss was a foregone conclusion. It gave the enemy a chance to make excellent use of a number of old Ju87s which they dared not use elsewhere. Since command of the air has become a necessary preliminary in both land and sea warfare it would appear that the staff ought to have foreseen the futility of attempting to hold the islands.

A Kittybomber squadron of the Desert Air Force taking off in clouds of dust.

WAR in the AIR

Airfields Dominate the Dodecanese : Americans Raid Norway : Russian Use of Aircraft

THE deplorable loss of Leros in the Dodecanese is discussed in our editorial columns this week. Once again it was a matter of airfields. The side which had the most convenient ones was able to overcome the side which could bring no short-range fighters into action, or at least not into effective action. The British troops on the island fought with the utmost gallantry, and it is reported that the Italians there fought well beside them. Incessant bombing, unchecked by fighter cover or even a reasonable amount of A.A. fire, made further resistance impossible. The Germans only claim to have taken 3,200 British prisoners and 5,350 Italians. The announcement from Hitler's headquarters tried to extol the feat of the Germans by saying that the enemy was superior in numbers and armament. This was meant to raise the spirits of German listeners, but the statement of the number of prisoners, and the further confession (which itself was almost certainly an exaggeration) that the A.A. guns captured numbered only 16 heavies, 20 of 20 mm. and 80 machine guns, shows that the equipment of the defenders against air attack was very slender.

Attempts were made to blunt the edge of the German attack by bombing their airfields on various islands and on the mainland of Greece. Eleusis near Athens was one of those bases, and the N.W. African Air Forces sent contingents of bombers there on many occasions, without succeeding in putting it out of action. One of the raids on the place was made by Yugoslav crews in Liberators supplied by the U.S. Army. The Yugoslavs had actually made their escape from that very airfield when the Germans invaded the Balkans, and doubtless they felt that this raid

R.A.F. officers inspecting a Saiman 202M captured in Italy. It is a development of a pre-war two-seater light monoplane with a 120 h.p. Alfa Romeo engine. There is also a four-seater, spatted model, the 204 R.

WAR IN THE AIR

of theirs was one preliminary step towards setting their own country as well as the other Balkan States free from the actual invader. There have also been many raids from Italy on German forces in Yugoslavia itself, where the Patriots are taking full advantage of the difficult straits in which Germany now finds herself to attack the enemy forces with increasing energy.

At the same time the squadrons of Gen. Spaatz have been paying a lot of attention to the routes by which the Germans in Italy draw their supplies. The railway routes through the Brenner and Mont Cenis have been put out of action, we all hope, for at least some time, but there remained the coast route along the Riviera. That has been bombed both from Great Britaina nd from Italy, railway bridges have been broken down, and the line extensively damaged. The name of Cannes recalls to many people of Britain and France delightful holidays, rest, gaiety and luxury. In the last war many wounded British officers and soldiers were sent to the Riviera to recuperate, and now German units are using the Côte d'Azure as a haven for recuperation. Well, the railway line along the Riviera has been broken in several places, and Cannes is not now so easily accessible. Units which have rested there cannot readily be summoned to the front in Italy, nor can battered battalions from the Sangro be easily sent off to the French watering places to refresh themselves and reform. More important still, supplies from France have for the time being no ready means of reaching Rommel.

Another forward step in the expansion of the power of the Eighth U.S. Air Force in Britain was marked by two American daylight raids on targets in Norway. Last week one formation bombed the mine works at Knaben, where the Germans have been getting their chief supplies of molybdenum, the metal used for hardening steel. On the same day another formation went for the power station at Rjukan. Photographic reconnaissance has shown that very useful damage was done.

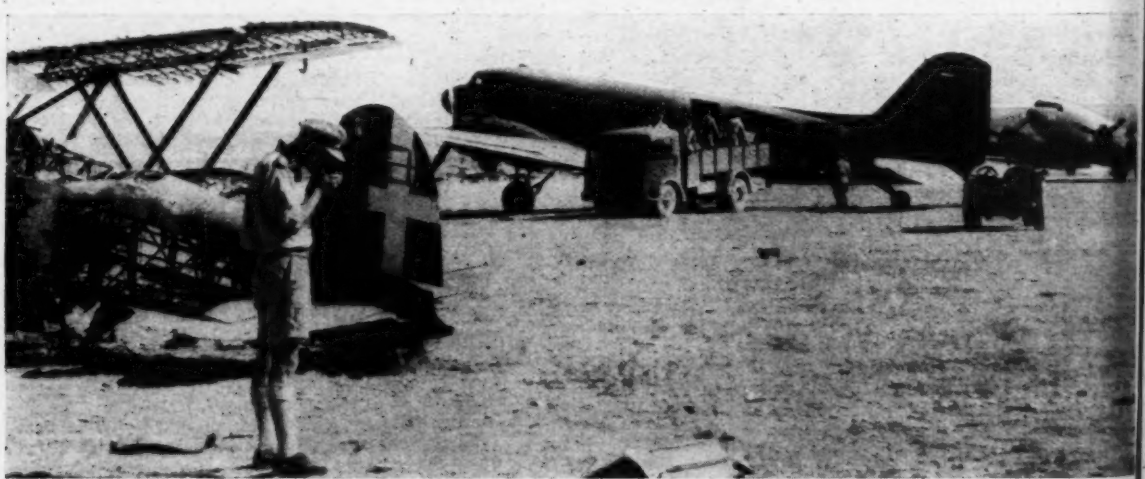
WING-TIP WHORLS : A remarkable photograph of a Beaufighter creating wing-tip vortices. These are like nothing compared with the vertical vortices created in the enemy during a Beaufighter attack.

An Allied spokesman has warned the French people that 36 places in France, including Paris, are from now on liable to mass air attacks by day or night, and the French were advised to take the necessary precautions.

Aircraft in Russia

THE amazing series of Russian victories cannot be said to have been checked by a German counter-attack to the south-west of Kiev, which is admitted to have regained some ground for the Germans. Repeated counter-attacks are expected all along the southern part of the front; they form part of the general German plan during their forced withdrawal. As a rule the Russians are not much incommoded by them, and the Moscow correspondent of *The Times* reports that there is some satisfaction at Soviet headquarters that the enemy should be expending his strength at a season when armour has little opportunity to exploit local successes, "and when the air arm, which generally is considered to play a more important part in German than in Russian offensive fighting, is much hampered by the weather."

This remark sets one thinking and wondering. Before the war Russia certainly thought a great deal about her Red Air Fleet, and was very proud of its numbers. It has often been remarked in these columns that Russian communiqués have given very scant recognition to the part played by this air arm in driving back the Germans, and that there has been far more stress laid on the work of Russian artillery. Yet the Russian forces are certainly now not less up-to-date than the Germans, although they probably suffered from



AIR LORRY : A Dakota being loaded on an Italian airfield. Hundreds of these transports serve the forces in the front line.

ENEMY AIR LOSSES TO NOV. 20th

	Over G.B.	Continent	Middle East	N.W. Africa
Nov. 14	0	0	1	9
,, 15	0	0	0	0
,, 16	1	0	1	13
,, 17	0	3	0	5
,, 18	0	1	0	1
,, 19	0	2	0	2
,, 20	2	4	0	0
	3	10	2	30

Totals: West, 7,725; Middle East, over 5,751; North-West Africa, 3,644.

that disability in the early days of the German invasion. The new Russian armies are evidently imbued with a new spirit, their officers have been improved in quality and status, and their new generals are obviously masters of tactics on the grand scale. In such a renovated Army one would have taken it for granted that the air arm would have played a most important part, as it has in the British Eighth Army. And, no doubt, the Red Air Fleet *has* played an important part in the great Russian defence as well as in the great Russian advance.

One had noticed that Russian military thought has not dwelt much on independent air action. It has indulged in very little of it, and it has been inclined to minimise, except for an occasional complimentary remark by Marshal Stalin or another, the utility of the British air offensive on Germany. Nevertheless, one would have expected the air arm to rank high among the various arms of the Red Army, in offence as well as in defence.

Perhaps Russian thought runs somewhat on these lines: in defence use your fighters to hold off the enemy's air effort; in both attack and in defence turn your own bombers on to the enemy's back areas and communications; but, when a target is within range of your artillery, turn your guns on to it, and keep your bombers for other targets which the guns cannot reach. With the last of those maxims there need be no quarrel; though it can be added that if and when you have gained absolute air superiority (a rare condition of things) bombers can fly where they like and can with advantage supplement the destruction wrought by the artillery.

Another report from the Russian front says that of late the Germans have been withdrawing their aircraft from the Ukraine. Something of the sort was to be expected, when one considers how the responsibilities of the *Luftwaffe* have recently expanded.

Heavy Raid on Berlin

LAST week there were two raids by Bomber Command on Ludwigshafen and a very heavy raid on Berlin. The first of the two attacks on Ludwigshafen was remarkable because the R.A.F. used new tactics, and dropped only high explosives. Nevertheless, these bombs started a number of fires. The force which Bomber Command sent out was not a very large one, and it was not strongly attacked. Only one bomber was lost.

BRITISH & U.S. AIR LOSSES TO NOV. 20th

	Over G.B. A'crft.	Continent B'brs.	Continent F'trs.	Middle East A'crft.	N.W. Africa A'crft.
Nov.					
14	0	0	0	9	0
15	0	2	2	0	2
16	0	0	0	3	3
17	0	4	2	0	2
18	0	32	1	0	2
19	0	5	3	1	3
20	0	0	0	0	1
	0	43	8	13	13

Totals: West, 8,415; Middle East, about 2,335; North-West Africa, 1,350.

On the next night, November 18th, Bomber Command made a new record by sending out more bombers over Germany than ever before. There were two major raids, one on Ludwigshafen again and the other on Berlin. The latter was also a record by itself, for Berlin had never before experienced such a gruelling ordeal. More than 350 bombs of the 4,000 lb. calibre were sent down on the German capital, and it was all over in half an hour. The weather was very thick, and the crews could not see much of what was happening down below, but they could see the coloured flares indicating the targets which the Pathfinders had dropped. The weather also hampered the searchlights, and many crews saw no German fighters. The *flak* was heavy, but was badly aimed, and took the form of a barrage. The 32 machines lost represented only a small percentage of the number of bombers sent out.

STREAKING FOR THE TARGET: The fantastic pattern made by the air trails of a formation of U.S.A.A.F. Fortresses. These trails are formed from the engine exhausts and are quite different from the wing-tip trails shown on the opposite page.

Gatwick Airport

Four Development Schemes Outlined by Experienced Airport Architects

POSSIBLE PROSPECT : This perspective sketch of the suggested "Continental" scheme for the development of Gatwick's airport gives a good idea of how its road-rail-air terminal would appear. The station, at present serving the racecourse, would have approach roads from north and south and be connected to the terminal building by the covered link shown.

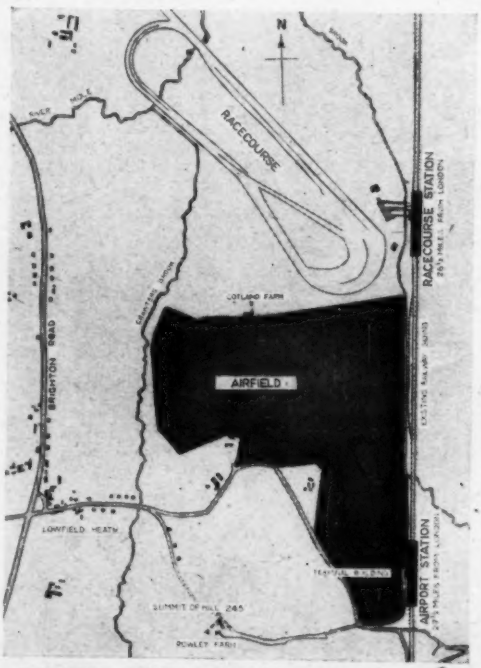
POSSIBLE developments of Gatwick airport have been outlined in a report prepared by Norman and Dawbarn, the well-known airport architects, in which is envisaged four possible schemes, namely, a "small or local scheme" which entails no disturbance of the Brighton Road, the racecourse, the existing airport buildings, nor the River Mole; a "continental scheme" which involves diverting the Brighton Road, removing the racecourse and existing buildings, and culverting or diverting parts of the River Mole; a "Trans-Atlantic scheme" involving diverting the Brighton Road between its northern limit at Povey Cross and southern limit at Crawley, and taking in everything between this convex western boundary and the existing Southern Railway line which forms its eastern boundary; and, fourthly, a partial development of the "Continental scheme" bounded on the west by the existing Brighton Road and taking in the greater part of the existing racecourse to the north.

All these projected schemes, it should be stressed, front on to the Southern Railway's London-Brighton line which it is not proposed to disturb beyond a rearrangement of the existing stations. The present western boundary of Gatwick airport lies just inside Crawter's Brook, to the north lies Cotland Farm and the racecourse, and to the south it is bounded by the road from the village of Lowfield Heath, past the hill near Rowley Farm, to the present airport railway station at its extreme south-east corner.

Two-stage Scheme

The most interesting proposals are those of the Continental scheme and its partial development pending the diversion of the Brighton Road and the culverting or diversion of the River Mole. These are well illustrated on page 579 by superimposing the smaller upon the greater.

Dealing first of all with the small or "local" scheme, its object is to show possible development with a minimum disturbance of the existing landscape, particularly the London-Brighton Road. In this the natural boundaries formed by the River Mole and the Racecourse on the north, the Brighton Road on the west, and the village of Lowfield Heath to the south-west are undisturbed. But the road from Lowfield Heath to the airport station is diverted, a few bungalows and other small buildings removed, and Crawter's Brook is extensively culverted. The existing airport buildings are retained in this "local" scheme although, as Norman and Dawbarn agree in their report, "they may be considered as open to some objection both in plan and siting." What might at first appear to be an even greater disadvantage is that the longest runway of 2,000yd. is roughly N.W.-S.E., whereas the runways nearest to the prevailing wind, which run W.S.W.-E.N.E. and S.S.W.-N.N.E. are only 1,530yd and 1,300yd. respectively. The fourth runway runs W.N.W.-E.S.E. and is 1,600yd. With the steadily increasing wing-loading and landing speeds of aircraft, however, this question of wind direction is already dwindling in importance, and it is likely that by the time such a scheme could be ready for actual use, drift would be of very trifling significance.



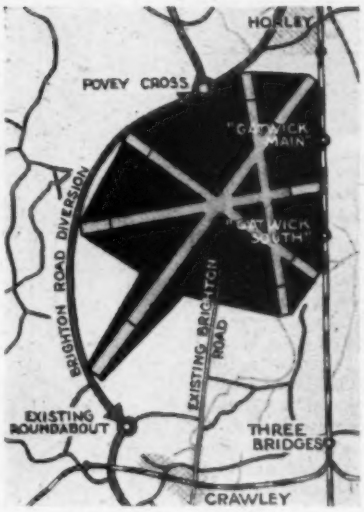
PRESENT PLAN : Gatwick's proportions as a pre-war civil airport. Compare them with the proposed schemes illustrated on page 579.

Turning now to the "continental" scheme, this entails the diversion of the Brighton Road as already stated, the culverting or diversion of the River Mole for a distance of some 1,400yd., and the absorption of the racecourse. The road from Lowfield Heath to the airport station would also have to be diverted rather more than in the case of the "local" scheme outlined above but still only to a comparatively unimportant extent. A section of the Mole and some subsidiary streams to the west would also have to be culverted or diverted. Incidentally (except to their occupiers!) the diversion of the Brighton Road would involve the removal of a certain number of houses, mostly small ones, which at present border it between Povey Cross

and the outskirts of Lowfield Heath.

The report points out that the reduction and redistribution of racecourses throughout the country has already been foreshadowed, and the disappearance of this one from its present site would enable the present Racecourse Halt to be converted into the airport's main railway station.

The layout of the airfield provides main parallel runways, set at right angles to each other, each of 2,500 yd., and two subsidiary runways of 1,450 yd. and 1,500 yd. respectively. The proposed terminal building is some 400ft. from the railway and has a continuous loading canopy 100ft. deep extending for a length of 1,500ft. on its west, or landing-ground, side; between the station platforms and the east side of the building is a car park of some ten acres. Terminal building and railway station are directly connected by a raised link of which the first floor would be devoted entirely to pedestrian, baggage and mail traffic (with escalators and conveyors at each end), whilst the upper floors would house administration and control.



CROSS-COUNTRY: A main runway of 4,000/6,000 yd. is the main feature of the architects' "Trans-Atlantic" layout. Note the Brighton Road diversion.

Refuelling is provided for to the south of the loading area with the petrol companies' offices and bulk storage off the access road adjoining, and the main servicing area is north-west of the terminal building, its buildings and large apron covering an area of about 450,000 sq. ft. The total area covered by this continental scheme is 1,180 acres.

Runway Lengths

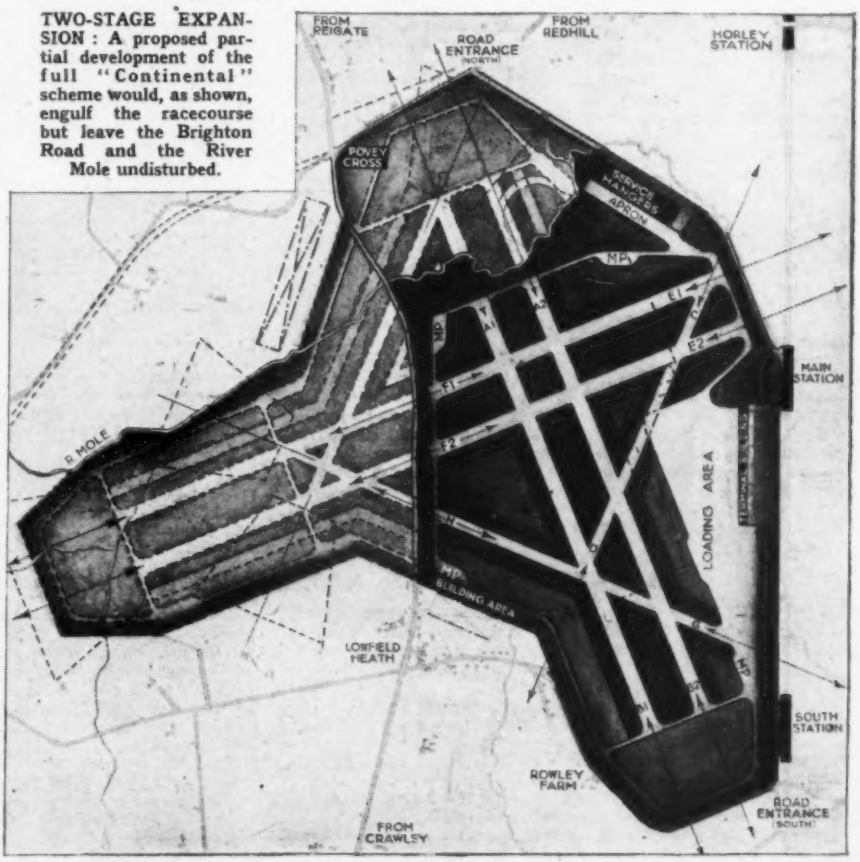
The third scheme mentioned in the opening paragraph, which is a partial development of the continental scheme, really differs from it only in the length of its runways; the general layout is the same. It absorbs the racecourse to the north and calls for the same deviation of the road from Lowfield Heath on its southern boundary, but its western boundary is the existing Brighton Road, and it accepts the limitation imposed by the River Mole on the north side. The proposed arrangements for railway stations, terminal buildings and essential services are identical with those of the complete continental scheme, as is the layout of the runways. But the restricted boundaries to the west and north-west limit the length of the main parallel runways (marked A1-B1, A2-B2, and E1-F1, E2-F2 on the plan) to 2,000 yd. and 1,200/1,400 yd. respectively. The subsidiary diagonal runways are also reduced to 1,400 yd. and 1,170/1,350 yd., and there is the indicated restriction on the perimeter taxiways. The runway lengths in this partial development of the continental scheme, in fact, can be compared with those of the small or "local" scheme with the important difference that the latter is not designed for expansion.

Transatlantic Layout

Suggestions for the "transatlantic" scheme are limited in the report, to the key plan reproduced alongside, since it is agreed that this phase of air transport must be regarded as an entirely special case with its own particular airport requirements, and may not best be operated from a site due south of London. Nevertheless, the communications and potentialities of Gatwick are such as to make it worth while noting the physical possibilities of establishing a transatlantic airport there, and the aforementioned plan indicates one main surfaced runway of 4,000 yd. in the direction of the prevailing wind, and three other surfaced runways each of 3,000 yd. The total lengths between the boundaries are respectively 6,000 yd. and 4,000 yd., and it would, of course, be possible to surface these full lengths if the overruns so obtained were necessary to ensure 100 per cent. regularity of operation for all land-based aircraft types that can be envisaged for future transatlantic use.

The provision of parallel runways is not included, but the width of the surfacing on each runway would be

TWO-STAGE EXPANSION: A proposed partial development of the full "Continental" scheme would, as shown, engulf the racecourse but leave the Brighton Road and the River Mole undisturbed.



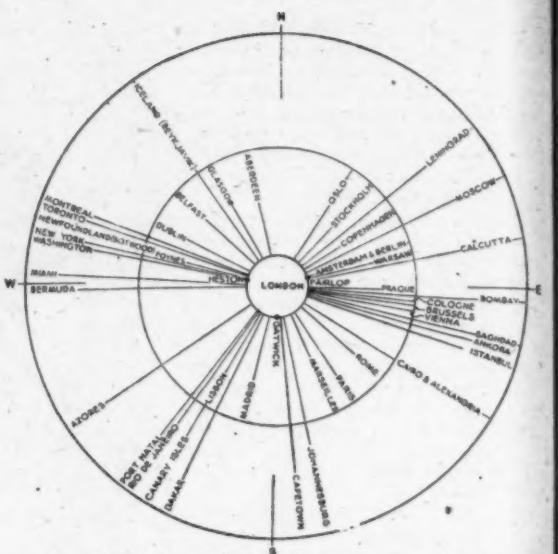
GATWICK AIRPORT

extended to 400ft. or 500ft., with a neutral area on each side to give a total width of 900ft. to 1,000ft., because the largest type of transatlantic aircraft would never, even in emergency, be carried on grass.

As will be seen by reference to the plan, the total main runway would extend from just south of Horley to the proposed deviation of the Brighton Road where it approaches the existing roundabout to the north-west of Crawley. Of the three shorter runways, two stretch from the railway to the westerly limits of the Brighton Road deviation and intersect the main runway approximately on the line of the present Brighton Road. The fourth runway, running roughly N.N.W.-S.S.E., reaches from the existing Horley-Povey Cross road, north-east of Povey Cross, to a point considerably S.E. of Lowfield Heath, the hill, and Rowley Farm which, if not "submerged" by the airport, would inevitably be flanked on three sides by its runways.

Accepting the principle that London will require more than one airport, the report suggests that these should be placed so that each could serve its own part of the world without crossing the city. The diagram (top, right) suggests a natural division of air traffic between Fairlop, Heston and Gatwick, and is concerned with direction only. Some of the most important towns within 1,000 miles of London are marked on the middle circle, and distant points on the outer one.

It is acknowledged that some of the world's air traffic will continue to be carried by flying boat, but the opinion is expressed that the "extreme difficulty" of finding ideal sites for marine airports in the southern half of England will result in an increasingly greater proportion of post-war air traffic being carried in land-based aircraft as adequate world facilities are provided.



PURELY DIAGRAMMATIC: Illustrating typical places which could be served by three London airports without crossing the city, this diagram is concerned only with direction. (See adjoining text.)

Reunited in South Africa

A REUNION dinner of those who before the war were connected with civil aviation, either as pilots or on the technical side, was recently held at the Grand Hotel, Salisbury, Southern Rhodesia. Nearly 70 sat down to dinner, representing some 32 Empire flying clubs and schools, five airline companies and some half a dozen aircraft companies. The chairman was that veteran aviator, Flt. Lt. C. L. Pashley, who has been flying for 34 years, and whose flying time is now approaching 13,000 hours.

The guest of honour was the Director of Civil Aviation, Southern Rhodesia, Air Vice-Marshal C. W. Meredith, C.B., C.B.E., A.F.C. The organisers of the dinner were Flt. Lt. C. Nepean Bishop, one-time of the Brooklands Flying Club, and Sqn. Ldr. D. D. Longmore, late of the Leicestershire Aero Club and Southern Rhodesia Government Travelling Flying School.

Air Vice-Marshal Meredith expressed his great pleasure at being made guest of honour at such a unique gathering. He referred to Flt. Lt. Pashley's great record, and said that "Rhodesia's Great Day" had come in early 1941, when Flt. Lt. Pashley entered the colony of Rhodesia.

Flt. Lt. Pashley welcomed all who were present and gave a few reminiscences of the early days of aviation. His story of how he once had to land on the side of a Sussex hill, taxy to the top and take off down the other side (because he could not climb over it!) was much appreciated.

Flt. Lt. C. Nepean Bishop hoped to repeat the function next year, a remark which was greated with applause.

The following clubs and schools were represented: Marshalls Flying School (Wing Cdr. Grace and Flt. Lt. Bentley); Brooklands Flying Club, Reading Aero Club, Portsmouth Aero Club (Flt. Lt. Nepean Bishop); Leicestershire Aero Club (Sqn. Ldr. Longmore); Heston Flying Club (Flt. Lt. G. S. Parker); Air Service Training, Ltd. (Flt. Lt. R. C. Griffin); Bristol Flying Club (Flt. Lt. Wingate Hill); South Coast Flying Club and Southern Aero Club (Flt. Lt. Pashley); London Air Park Flying Club (Flt. Lt. J. B. Collins and Flt. Lt. M. Lucani); Liverpool and District Flying Club (Flt. Lt. Latimer); Yorkshire Aeroplane Club (Flt. Lt. Micklethwaite, A.F.C.); Southend Flying Club (Sqn. Ldr. Wrightson); Redhill Flying Club (Flt. Lt. W. Shearman); Midland Aero Club (Flt. Lt. J. Jurdon); Lancashire Aero Club (Flt. Lt. Roughley); Midland Bank Flying Club (F/O. Gifford); London Aeroplane Club, Stag Lane (Mr. J. Forsyth); Air Touring, Gatwick (Sqn. Ldr. Porteous); Brooklands Aviation, Ltd., and Sywell (Sqn. Ldr. J. Ayling); N. Rhodesia Flying Club (Flt. Lt. Parbury and Sgt. Mackenzie); Salisbury Flying Club and D.H. Co., Salisbury (Sqn. Ldr. C. H. Prince); Bulawayo Flying Club (Mr. P. B. Gibbs); Johannesburg Light Aeroplane Club (Flt. Lt. Scrase); Lusaka Flying Club (Flt. Lt Ashby); Shabani Flying Club (F/O. Hill); Gatooma Flying Club (Mr. Attwell); Ottawa Flying Club (Sgt. W. Shennan); Maidstone Flying Club (F/O. Burnett); Kenya Flying Club (Flt. Lt. Leibbrandt).

Sqn. Ldr. C. A. Barnard represented Southern Rhodesia Air Services and Flt. Lt. Bourlay Rhodesia and Nyasaland Airways. Wing Cdr. J. C. Reynolds represented the De Havilland Co. at Hatfield and Flt. Lt. le Poor Trench the D.H. Technical School. Flt. Lt. Pennant-Rea was with Hawkers and later the De Havilland Co., Rhodesia.

COMMUNICATIONS SQUADRON'S 2,000,000 MILES

AIRCRAFT of a Naval Communications Squadron serving Scotland, the Orkneys, the Shetlands and Northern Ireland have completed 2,000,000 flying miles, carrying nearly 4,000,000 lb. of freight and more than 45,000 passengers.

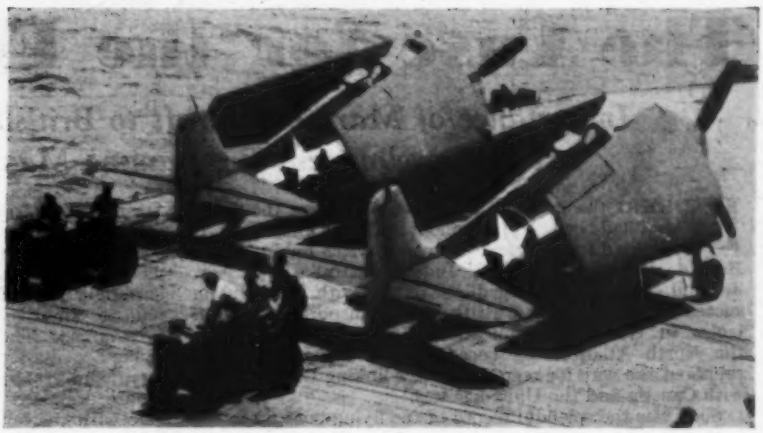
The aircraft transport every sort of freight from cabbages to King's messengers. Many times spare parts and air crews have been rushed to places from which they could be flown to carriers already at sea.

The invasion of North Africa and Salerno are two examples in which the squadron helped to make operations successful.

The pilots, under the command of Lt. Cdr. (A.) W. D. T. Gairdner, R.N.V.R., of Prestwick, Ayrshire, formerly Air Superintendent and Director of Scottish Airways, include some well-known flyers. Lt. Cdr. (A.) Neville Stack, R.N.V.R., was a test pilot before he joined the Royal Navy. Following a serious accident, doctors told him he might never fly again, but he has proved them wrong.

Lt. Cdr. (A.) W. B. Caldwell, R.N.V.R., of Southampton, and Lt. Cdr. (A.) G. H. G. S. Rayer, R.N.V.R., of Feltham, Sussex, flew for Jersey Airways and evacuated refugees by air from the Channel Islands during the German invasion. Both made their last flights from the islands under fire. Petty Officer (A.) F. C. Rice, of Colchester, Essex, won the D.S.M. in the second battle of Narvik, when he piloted a Swordfish catapulted from H.M.S. *Warspite*, and was "mentioned" after Matapan.

HERE AND THERE



DECK TUGS: Small motor tractors are used on American aircraft carriers for the easier movement of aircraft. These Hellcats formed part of the U.S. Navy task force that struck at Tarawa in the Gilbert Islands. Note how the wings, when folded back from the centre-section, also turn on edge.

Appointment

SIR ARCHIBALD SINCLAIR, Air Minister, has appointed Mr. R. C. Chilver as his principal private secretary in the place of Mr. R. H. Melville, promoted, the Air Ministry has announced.

Lisbon-Madrid Air Service

AFTER an interruption of eight months, the Iberia Air Transport Company has now resumed its service between Lisbon and Madrid, according to a message from Lisbon received recently by Reuter.

Wasps Without Stings

WOMEN pilots attached to the U.S.A.A.F. are to be officially known as "Wasps," the title of their organisation being the Women's Air Force Service Pilots.

They will wear wings on their blue uniforms, with W.A.S.P. in gilt letters on the lapel of the collar. Their flying, of course, will not include combat duties.

Rotol Recruit

DESIGNER of a number of world-famous high-speed boats, Mr. Fred Cooper, naval architect and marine engineer, has joined the staff of Rotol, Ltd.

After the last war he joined S. E. Saunders, Ltd., at Cowes, and subsequently became manager of the British Power Boat Co., leaving them later to set up his own business as a naval architect. He has been engaged on special designs for the Admiralty for several years.

Among many of his successful craft were Sir Malcolm Campbell's *Bluebird*, which captured the world's water speed record in 1938; the late Sir Henry Segrave's *Miss England I* and *Miss England II*, and Betty Carstairs' *Newg*, which was also a world's record holder in its class.

Mr. Fred Cooper

Colonial Air Needs

THE importance to our Colonies of developing their internal air communications was stressed by Col. Oliver Stanley, Colonial Secretary, when he described a recent tour of West and East Africa to the Royal Empire Society.

Air transport inside the Colonies, he told his audience, had as great a value in furthering their development as had air transport between themselves and Great Britain.

The fact that lack of air transport had prevented his visiting many places had convinced him of this, and he hoped we should not look upon it as a purely commercial venture. He covered 20,000 miles in six weeks, and visited nine Colonial territories.

Mosquito Fighter-bomber

IT is now permitted to disclose another version of the DH Mosquito in addition to the fifteen different models reviewed in *Flight* of November 11th.

This is the Mosquito fighter-bomber which is used for "intruder" duties as well as the ordinary fighters.

Basically the Mark II fighter, a photograph of which headed the article on "Mosquito Versatility," the fighter-bomber can carry a bomb-load of 1,000lb. in addition to its normal fighter armament of four 0.303in. machine guns and four 20 mm. cannon.

Wing drop-tanks are also fitted to this version.

Sorrell Sobers Them

DR. LEWIS SORRELL, Professor of Transportation at Chicago University, has thrown cold water over the numerous American airline operators who have recently been scrambling somewhat wildly for C.A.B.'s sanction to operate world air routes. He has carried out a survey in great detail and as a result of his report the air lines have been advised that not more than 100,000 to 150,000 tons of commercial freight at the very most can be expected to fly in and out of the U.S. annually—even three to five years after the war.

It is pointed out that this traffic could be handled by fewer than 500 aircraft of the Clipper type averaging twenty return trips a year with 8½ ton loads, or by 70 flying boats such as Kaiser is now building, each carrying 60 tons and making the same number of journeys.

Dr. Sorrell's findings are thought likely to influence C.A.B. in granting certificates of "convenience and necessity" to the competing air lines.

Air Flivver for £375

A REPORT from New York announces that orders are now being taken for immediate post-war delivery of "the Tin Lizzie of the air."

This is said to be an all-metal aircraft with a 65 h.p. engine, "giving 25 miles to the gallon and 100 m.p.h."

Two models, it would appear, are to be available, a two-seater at £375 and a four-seater at £500. It has dual control, and "anyone can learn to fly it in five hours."

Optimism

MR. W. H. EISENMAN, national secretary of the American Society of Metals, is reported to have made the following statement at a luncheon address in Winnipeg.

"After the war, people will buy helicopters for $1,500 to $1,700, learn to fly them in five to ten minutes and be home for dinner at the rate of 120 m.p.h.

What a swell lunch that must have been!

Daylight sweep.

D

The Case for the Flying Boat*

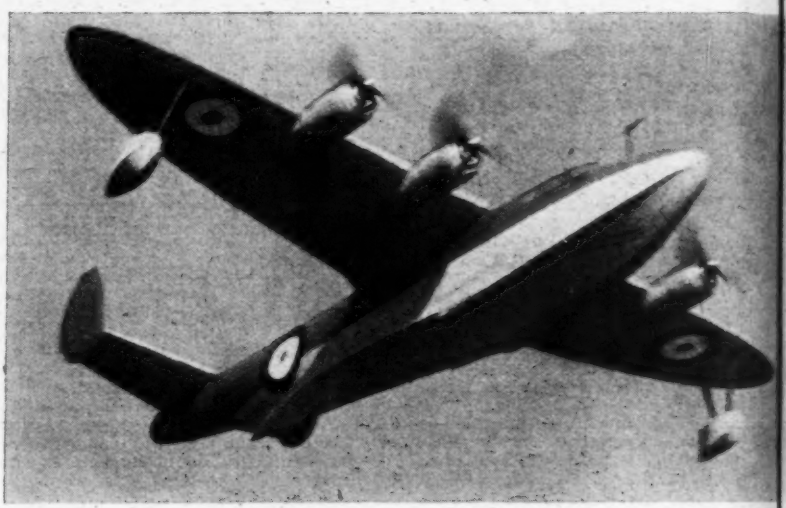
Importance of Marine Aircraft to British Empire : Danger that Development Programme May Overlook It

DURING the last few years before the war the flying boat had become pre-eminent in British air transport. Adopted for the great air mail services linking Great Britain with South Africa, India, Australia and New Zealand, it had discharged its duties with outstanding success, and established British air transport as a vital factor in World communications. Pioneer services over the North Atlantic—all based on the flying boat—had prepared the way for regular services linking Great Britain with Canada and the United States.

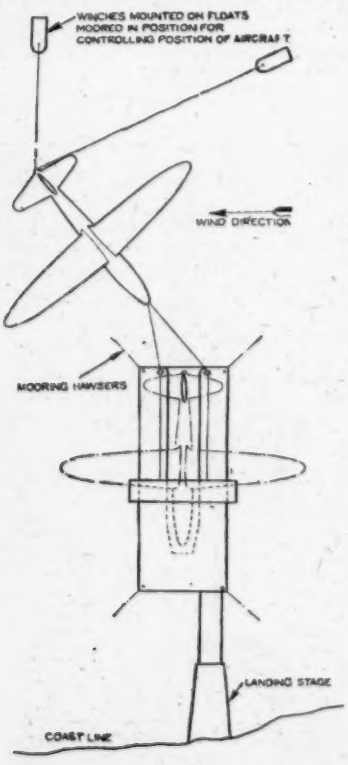
Such was the splendid record of the flying boat up to the outbreak of war. Since then it has been making a major contribution to the war effort of the United Nations, not only in its direct military applications, but also by maintaining communications between the various centres of activity all over the World. Thus, although the landplane may have played a more spectacular part in actual war operations, the achievements of the flying boat have been of no small account. Its pre-war record has been well upheld.

Yet, in spite of this record, in spite of the special importance of the flying boat to the maritime peoples of the British Commonwealth, there is a danger that it will not be given its proper place in the programme of development for the future. In recent months attention has been focused on the importance of developing new British types of commercial aircraft for post-war services, and the Government has announced its decision to proceed with at least four specific types. But there is so far nothing to indicate that the flying boat is to be included in this programme. The purpose of this report is to claim for the flying boat its rightful place in this programme of development, and to show that it can achieve just as great advances as are promised by the landplane. If developed side by side with the landplane it can make a great contribution to the success of British air transport in the future, as it

* From a report prepared by Saunders-Roe, Ltd.

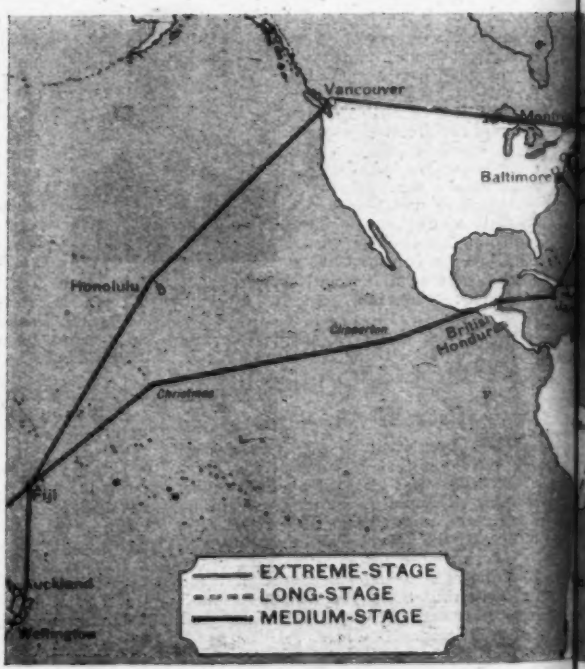


This "flying scale model" Saro boat had four 90 h.p. Pobjoy engines. The full-size boat envisaged for scheme X in the table on page 585 is closely based on it.

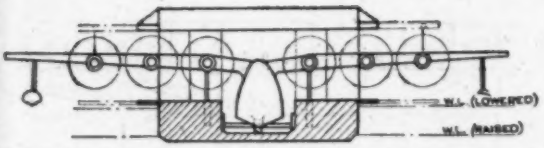

WINCHES MOUNTED ON FLOATS MOORED IN POSITION FOR CONTROLLING POSITION OF AIRCRAFT
WIND DIRECTION
MOORING HAWSERS
LANDING STAGE
COAST LINE

16

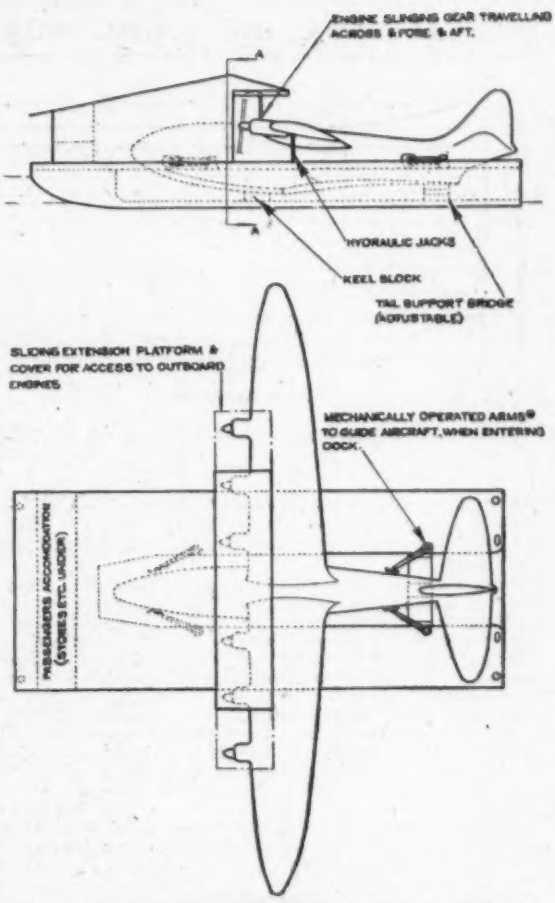
Suggested method of docking a flying boat of the future.



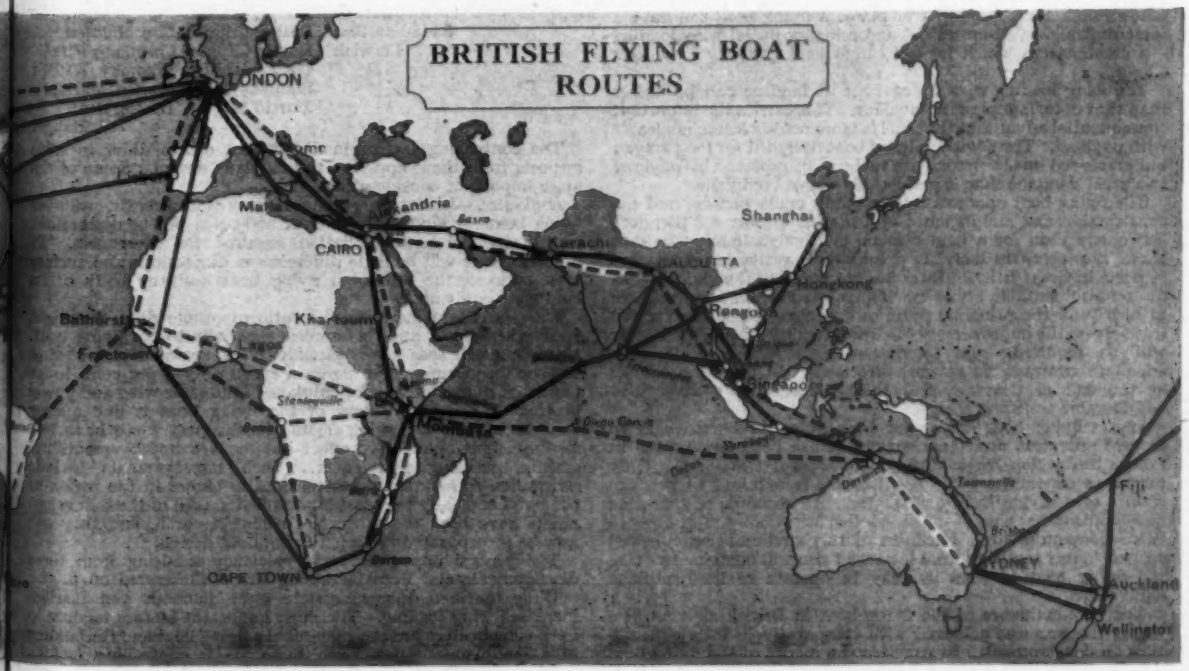
This map shows possible world air routes calling for three types of service. Longest stages are given in the table.



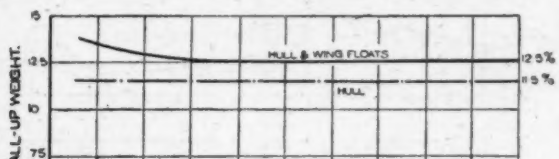
Type of service	*Route*	*Longest stage in miles (approx.)*
Extreme-stage	London – Montreal – Vancouver – Fiji – Wellington	3,250
	London – New York	3,450
	London – Bermuda – New York (with alternative of Baltimore or Norfolk)	3,450
	London – Bermuda – Jamaica – British Honduras – Clipperton – Christmas Island – Fiji – Australia (or N.Z.)	,450
	London – Lisbon – Bermuda	3,100
	London – Freetown – Capetown	3,500
	or London – Lagos – Capetown	3,150
Long-stage	London – Botwood – Montreal (or N.Y.)	2,350
	London – Lisbon – Bathurst – Natal – Rio de Janeiro – Montevideo – Buenos Aires	1,850
	London – Lisbon – Bathurst – Boma – Capetown	2,400
	London – Cairo – Mombasa – Durban	2,400
	London – Cairo – Karachi – Calcutta – Singapore – Darwin – Sydney	2,200
	Bathurst – Lagos – Stanleyville – Mombasa	1,800
	Boma – Mombasa – Diego Garcia – Cocos Island – Darwin	2,300
Medium-stage	London – Rome – Alexandria – Basra – Karachi – Calcutta – Rangoon – Singapore – Sourabaya – Darwin – Townsville – Brisbane – Sydney – Wellington or Auckland	1,400
	London – Malta – Cairo – Khartoum – Kisumu – Mombasa – Beira – Durban – Capetown	1,300
	Mombasa – Seychelles – Maldive Islands – Trincomalee – Penang – Singapore – Saigon – Hongkong – Shanghai	1,400
	or Trincomalee – Rangoon – Hongkong – Shanghai	
	or Trincomalee – Calcutta	

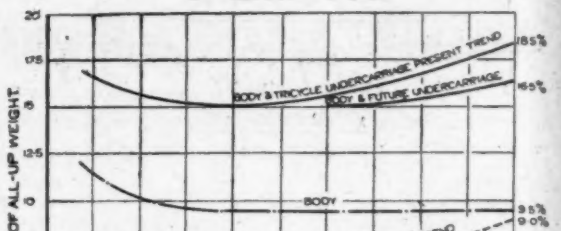

ENGINE SLINGING GEAR TRAVELLING ACROSS & FORE & AFT.
HYDRAULIC JACKS
KEEL BLOCK
TAIL SUPPORT BRIDGE (ADJUSTABLE)
SLIDING EXTENSION PLATFORM & COVER FOR ACCESS TO OUTBOARD ENGINES
MECHANICALLY OPERATED ARMS TO GUIDE AIRCRAFT, WHEN ENTERING DOCK.
PASSENGERS ACCOMMODATION (STORES ETC. UNDER)

Three-view general arrangement drawing of a flying boat dock.



THE CASE FOR THE FLYING BOAT





Variation of component weights with size. On the left, hull and wing-float weights of flying boats. Right, fuselage and undercarriage weights of landplanes.

has in the past. But, inevitably, if its development is neglected now that contribution will be lost, and British aviation may suffer a setback from which it will take years to recover.

There are many arguments in favour of the flying boat and many in favour of the landplane. There are routes which are particularly suitable for either one or the other, and there are also routes on which both can be usefully employed. No elaborate analysis of their respective merits will be attempted in this brief report; a summary of the more important advantages of the flying boat will be sufficient to establish its claim to immediate further development side by side with the landplane.

The flying boat offers better scope for the development of very large types in the future. As size increases the flying boat gains in relation to the landplane, both as to aerodynamic efficiency and as to structure weight. Moreover, as size increases the seaworthiness and operational qualities of the flying boat improve. With landplanes increased size accentuates the difficulty of providing suitable airfields and designing satisfactory and reasonably light undercarriages.

Take-off Run

The flying boat can be allowed a longer take-off run than is feasible for a landplane, even assuming the availability of airports with long-prepared runways on all routes. It follows that, for a given power plant, a flying boat can have a somewhat higher all-up weight and a higher initial wing loading—a combination which leads to high load capacity over long stages.

The wing loading of a flying boat at landing can be higher than that of its landplane equivalent. This carries the important consequential advantage that fuel is more readily interchangeable with payload. Thus, with a flying boat designed for long stages, but employed on shorter stages, fuel can be replaced by payload to a greater extent than is permissible with a landplane.

The flying boat operates from a ready made surface, and the construction and maintenance of a marine airport are therefore less costly than for a land airport. Although it happens that there are comparatively few harbours available as marine airports in Great Britain, this does not apply to the main British air routes; suitable stretches of protected water are available at nearly all the principal ports of call along these routes, and it is only on the improvement of airport facilities that expenditure will be required. On some routes modern airports with adequate runways in several directions will not be available at the end of the war, and their construction will involve considerable time and cost.

If the flying boat has so far been at a disadvantage as to ease of operation and maintenance, it has been largely due to failure to develop reasonably adequate airport facilities. Only moderate expenditure in this direction is required to produce results of a revolutionary character. An example of one such development—a simple form of floating dock—is shown in three views on p. 583. Facilities of this kind and the improved seaworthiness resulting from increased size will combine to make the flying boat at least as easy to operate as its landplane equivalent.

The pre-eminence of the flying boat in British air transport before the war was achieved with comparatively little expenditure on development. In America the merits of the flying boat were more widely appreciated, and the programme of development there has been on a far greater scale than in Great Britain. The following table shows how concentrated was the development of flying boats in America during the pre-war years, 1934–1938, and how that development has continued during the war. There now exist several American types of long-range flying boat suitable for the operation of ocean routes and, in addition, there will be newer types available as the result of war-time development.

Military Development

Flying boat development in Great Britain at the present time is confined to Service types. Unfortunately, the military requirements which the Service type must meet react against its adaptability for civil use; on the one hand its performance will be inadequate, and on the other it will not offer the essential feature of hull pressurising. The future requirements of air transport cannot be met by merely adapting military designs; they demand new and specialised development.

Development of Flying Boats, 1934/1941

BRITISH		AMERICAN	
Civil	*Military*	*Civil*	*Military*
Short Empire	Saunders-Roe R2/33	Sikorsky S42	Consolidated Catalina PBY
Short G boat	Short Sunderland	Martin 130	Douglas amphibian
	Saunders-Roe Lerwick	Sikorsky S43	Douglas DF
		Boeing Clipper	Consolidated Coronado PB2Y
		Martin Clipper	Sikorsky XPBS1
		Consolidated 31	Martin Mariner
		Sikorsky V44	Boeing Sea Ranger
		Martin Mars	

The controlling factors in flying boat design differ in some respects from those applying to landplane design. Some of the more important considerations are:—

Hull size.—In future types of passenger aircraft, whether flying boats or landplanes, hull or body size will be determined mainly by the accommodation required for passengers. In practice there will be little difference in dimensions and surface area between the hull of a flying boat and the body of its landplane equivalent.

Drag.—As size increases the ratio of profile drag to weight tends to improve, and this applies especially to the flying boat. In a particular case investigated a civil transport flying boat of 160,000 lb. all-up weight shows a speed only 4 per cent. lower than that of an equivalent landplane of the same wing and power loadings. The higher drag of the flying boat is due mainly to steps, chines and wing floats; in the past these have had an important cumulative effect but modern improvements are greatly reducing this effect. Such improvements include streamline retractable steps, retractable chines in the region of the bows and fully retractable wing floats. All of these developments have been the subject of recent research, and they can now be incorporated in actual flying boat design.

The general improvement in efficiency resulting from these developments and from increasing size is illustrated on p. 584.

Wing loading.—Increasing size both demands and justifies increased wing loading. The most important factors tending to limit wing loading are the take-off of a flying boat and the landing of a landplane. Apart from these major controlling factors,

THE CASE FOR THE FLYING BOAT

the optimum wing loading is influenced by the desired operating height and cruising speed, and the power loading.

These factors and many others have been taken into consideration in an investigation of a series of civil flying boat types, which indicates an optimum loading of 56-60 lb. per sq. ft. at take-off under temperate conditions, and 45-50 lb. per sq. ft. in the tropics. Wing loading at landing must be based mainly on operating experience, which at present indicates a maximum of about 42 lb. per sq. ft. under temperate conditions, and about 38 lb. per sq. ft. in the tropics. Higher wing loadings, both for take-off and landing, may become desirable and practicable in the future, but in any case it appears that the flying boat should always be able to go further than the landplane in this direction.

Structure weight.—The natural dimensional law rules that as size increases structure weight, expressed as a percentage of all-up weight, must tend to rise. But this law can be circumvented in various ways, and the large flying boat offers particularly good scope to the designer in this respect.

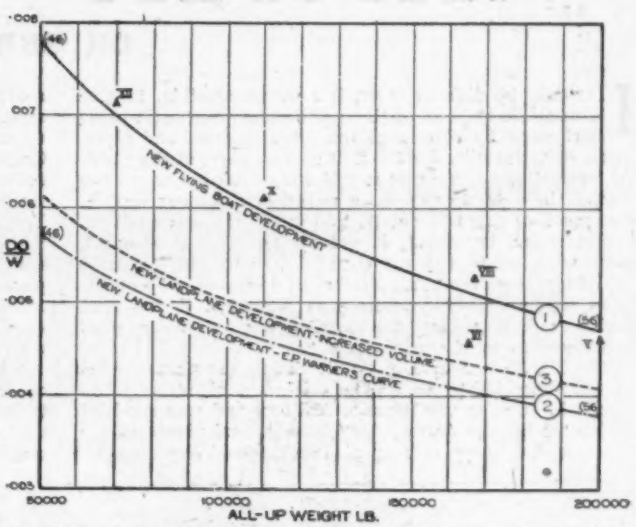
Increased wing loading is of first importance, for it not only reduces wing size and weight but sets the scale for other dimensions of the aircraft. A wing structure embodying a continuous stressed skin is also an important feature, and as size increases this feature can be more economically achieved.

Investigations into new methods of construction show that saving in weight can be effected throughout the structure, particularly as size increases.

In comparing the flying boat and the landplane the main components involving weight differences are: for the flying boat the hull and wing floats, and for the landplane the body and undercarriage. For similar wing areas all other components are virtually common to the two classes.

For a particular civil transport landplane investigated the body represents 9.5 per cent. of the all-up weight; for the equivalent flying boat with the same cubic space for passengers the hull represents 11.5 per cent. of the all-up weight. There is thus a difference of 2 per cent. in favour of the landplane in this respect. On the other hand, as size increases undercarriage weight represents an increasing percentage of all-up weight. For the larger sizes of landplane the undercarriage, whatever its type or design, is unlikely to be less than 6 per cent. of the all-up weight. Against this must be set the weight of wing floats in a flying boat which can be designed to be less than 1 per cent. of the all-up weight.

These considerations lead to the conclusion that, in the larger sizes of aircraft, there will be an advantage in structure weight of at least 3 per cent. in favour of the flying boat. The curves shown on the previous page illustrate this advantage.



Variation of drag-weight ratio with size. Curves show total profile drag (at 100 ft. per sec.) over all-up weight, plotted against all-up weight. Figures at ends of curves indicate wing loadings, while plotting points represent Saro flying-boat schemes.

Hull pressurising.—It is generally agreed that pressurising has become a necessity for all future long range transport aircraft. Can the flying boat meet this demand? Up to now there has been a widespread impression that it cannot, but in our view this impression is not justified. Investigations have shown that pressurising, to any desired degree, can be incorporated in a flying boat hull without any appreciably greater sacrifice in weight than is involved in the case of a landplane. Designed, as it is, to withstand water pressures up to 40 lb. per sq. in., the whole forward and amidships construction of a flying boat hull must necessarily be so robust that provision for internal pressurising will not involve any substantial increase in weight. All the alternative schemes suggested later in this report incorporate pressurising, either in single or two-deck arrangements, and in each case the weight involved is allowed for in the table of characteristics.

Ever since the inauguration of civil air transport after the last war the demand for long range has steadily increased. But a study of present and probable future air routes suggests that so

(*Continued on page* 595.)

CHARACTERISTICS OF FLYING BOATS SUGGESTED FOR DEVELOPMENT.

Type of Service.		**Extreme-stage.**		**Long-stage.**				**Medium-stage.**	
Saunders-Roe reference.	**Scheme.**	**V**	**VI**	**VIII**		**X**		**XII**	
Effective range allowing for take-off, climb, 50 m.p.h. headwind and 5% deviation from course	Miles	3,450	3,450	2,300		2,300		1,400	
All-up weight	lb.	200,000	165,000	165,000		110,000		70,000	
Number of engines		6	6	6		4		4	
Operating height	ft.	20,000	20,000	20,000		20,000		20,000	
Mean cruising speed	m.p.h.	230	260	240 With Mail		230 With Mail		226 With Mail	
Number of crew		12	11	12	12	12	11	12	11
Net payload	lb.	15,000	9,600	11,000	12,250	7,700	8,675	7,150	8,400
Number of passengers		40	24	40	30	28	17	26	16
Passenger load at 175 lb. per passenger	lb.	7,000	4,200	7,000	5,250	4,900	2,975	4,550	2,800
Luggage load at 100 lb. per passenger	lb.	4,000	2,400	4,000	3,000	2,800	1,700	2,600	1,600
Mail load	lb.	4,000	3,000	—	4,000	—	3,000	—	4,000
Floor area per passenger	sq. ft.	37.5	22	37.4	50	20.7	34	16.7	27
Cubic space per passenger	cu. ft.	335	233	333	445	190	310	120	194
Cubic space as carrier	cu. ft.	14,450	6,100	10,700	—	6,100	—	3,660	—

Seventy-sixth of the Current Recognition Series

Aircraft Types and

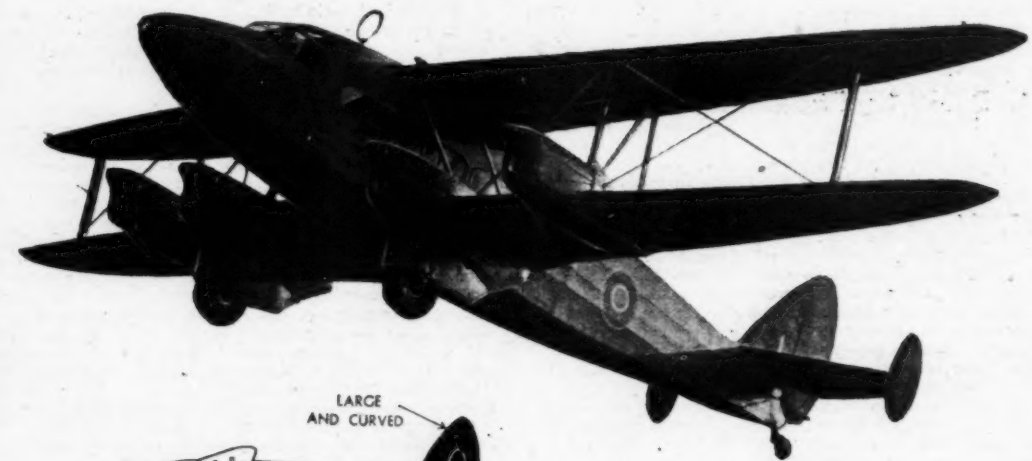
DH 86B

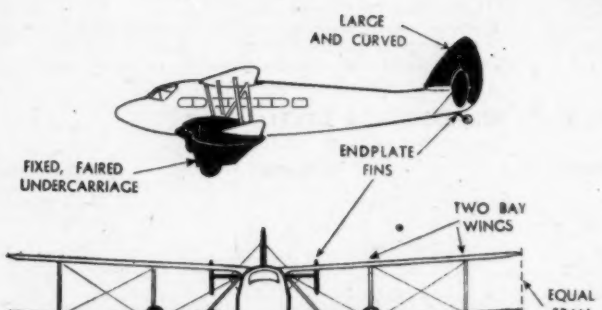
IT would be difficult, even it were permissible, to give a complete account of the multifarious duties still being performed by certain of the more modest, and older, types of de Havilland aircraft in various parts of the globe. At present the firm itself is collecting information on the subject in order to compile a record of their war service, but much of this will not be told until after the war.

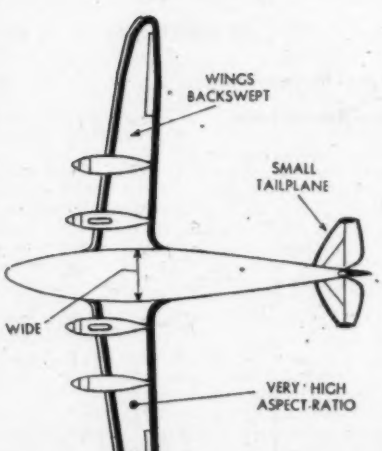
But it can be stated, in general terms, that among a number of other types originally designed for peaceful occasions, there are a fair number of de Havilland aircraft, aged relatives of the omnipotent Mosquito, if you like, which are still making unpretentious but extremely useful contributions to the war effort.

The DH 86 is a case in point, the most recent version of the series being 86B. The original design was introduced in 1934 as the Express Airliner, and was supplied to Qantas Empire Airways in Australia, and pioneered the Brisbane-Singapore section of the England-Australia air route. It was also the DH 86 which opened the night mail service from Gatwick to Hanover operated by British Airways in 1936. Imperial Airways acquired the DH 86A for Continental and Empire routes, and this modified version differed from the original in having a redesigned nose with accommodation for two pilots and additional luggage space The airframe was also strengthened to permit a higher maximum load. Then came the 86B, illustrated below, which has small, oval auxiliary fins mounted on the tailplane tips. Both the 86A and 86B are powered by four 200 h.p. inverted, air-cooled Gipsy Six Series II engines with controllable-pitch airscrews, in place of the Series I with fixed-pitch wooden airscrews.

Its cruising speed is 160 m.p.h. at 7,000ft., and service ceiling 18,000ft. Designed to carry 10 to 16 passengers, those ordered by the R.A.F. were employed originally on radio and navigational training as well as on the "communications" duties some of them still fulfil.







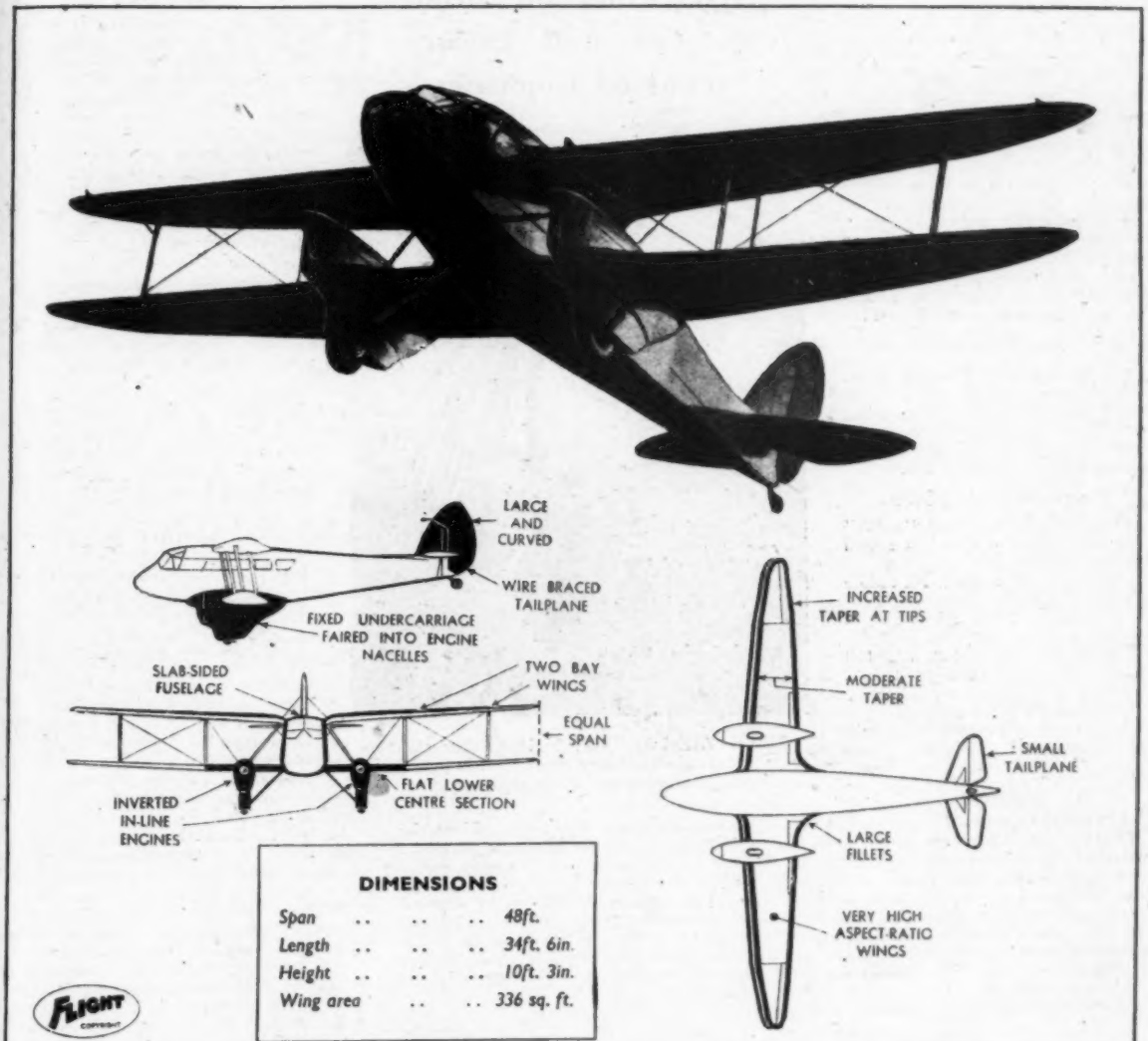
DIMENSIONS

Span	*64ft. 6in.*
Length	*46ft. 1½in.*
Height	*13ft. 10in.*
Wing area	*638 sq. ft.*

FLIGHT COPYRIGHT

Their Characteristics

DH 89A and 89B (DOMINIE)



DESIGNED primarily for the internal airline operator, the twin-engined DH 89A and 89B, which are identical except for equipment, are in service in considerable numbers with the R.A.F. The former is really the civil Dragon-Rapide, which was virtually the standard equipment of Railway Air Services, and is used both by the R.A.F. and the A.T.A. for communications and light transport work, while the 89B, or Dominie, is equipped as a wireless and navigational trainer with accommodation for four or five pupils and an instructor.

The "Rapide" was a development of the DH 84 Dragon, and was first introduced in 1934. It proved an immensely successful aircraft, for it carried eight to ten passengers at a useful speed for very low operating cost, and hundreds were built for almost every country in the world. Powered by two inverted, air-cooled Gipsy Six Series I engines, each of 200 h.p., it has a top speed of 157 m.p.h., and cruises at 132 m.p.h. on a fuel consumption of only 18 g.p.h. Like its bigger brother, the DH 86, the DH 89 did not boast flaps when first introduced in the days of peace, but both the 89A and 89B are now equipped with these aids to steeper and slower final approaches and landings.

An equal-span biplane, its two-bay wings are of very high aspect-ratio and, as on the "eighty-sixes," the outer inter-plane struts are single. But it differs in wing plan from the four-engined machine in that its wings are not backswept. The tail units of the two types are to all intents and purposes identical in form except for the auxiliary endplate fins on the 86B.

Another feature characteristic of both types is the fixed undercarriage, the fairing of which may be described as a downward extension of the engine nacelles. The much slimmer and shorter nose of the DH 89 type accommodates only one pilot, but the general lines of the two types are so similar that they are obviously "stablemates."

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

From Bulgaria

A GROUP of members of the Bulgarian Fascist Youth organisation "Brannik" have returned from Germany after a completion of a course in gliding. They will act as instructors in gliding courses which are shortly to be organised in Bulgaria.

Prussian Discipline

QUOTING the Belgian News Agency, Reuter says that a *Luftwaffe* Colonel has been killed by one of his men at Florennes, in the Belgian province of Namur.

There is much drunkenness among officers and men in the district, the report says, and when the men do not salute, the officers do not dare to reprimand them.

An Estimate

ACCORDING to German reports, Russian aircraft losses since the beginning of the offensive on July 5th amount of 10,225 aircraft, of which 534 have been brought down by army A.A. units.

Conversation Piece

A SCENE in a Berlin "local" reported by the German Broadcasting Service.)

1st Guest: Now, then, I'll toddle home. . . .

2nd Guest: Why? It's not eight o'clock yet?

1st Guest: Yes, but it's full moon, isn't it? To-night they'll come.

2nd Guest: Who?

1st Guest: *Himmel*, you talk like Adam. You know only too well. . . .

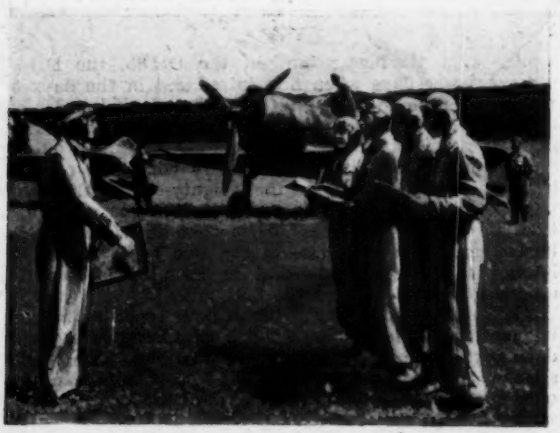
CATCH THEM YOUNG: In Japan little children are receiving elementary instruction in parachute jumping. Tuition starts at the kindergarten stage.

Awards

WITH the consent of Goering and its Honorary Chairman, General Field Marshal Milch, the German Academy for Aeronautical Research has awarded for the first time several special Lilienthal Society prizes: these prizes, totalling 100,000 RM, were founded in 1942, and are distributed annually for the most outstanding work in aeronautical science and technique.

Professor Cranz, a specialist in ballistics, receives the *Luftwaffe* prize; the Carl-Bosch award for scientific work was given to Professor Rein, of Goettingen, for his successful air-physiological researches. Professor Dieckman, director of the Aeronautical Wireless Research Institute of Munich, received the Navigation prize, and the Lilienthal Society Prize for fine arts goes to Professor Arno Breker.

The Hencke-von-Moreau prize was posthumously awarded to Maj. Gen. von Goblenz, Director of the *Lufthansa* and a member of the German Ministry of Education. Krummel, who lost his life in the same flying accident, prize for the promotion of scientific technical training.



FLYING EQUIPMENT OF HUNGARY'S AIR FORCE IS OF MOTLEY ORIGIN: Here is a unit with a Reggiane Re 2000.

Apathy

BOMBING is undoubtedly the worst affliction of the German population and the one which has very suddenly changed their attitude towards the war, says a neutral just returned from Germany.

This man, an astute observer, who has spent several years in Germany, considers that until British aircraft appeared over Berlin the war was not taken very seriously. Nowadays life is so gloomy that people are no longer interested in who will win the war, their attention being focused on three simple and trivial problems: food, sleep and shelter.

Another Secret

THE German controlled Paris Radio, quoting Berlin sources, says that a new type of aircraft which is still on the secret list was partly responsible for the German capture of Leros.

Another Ju

DETAILS are now available of the new Ju 188 employed by the *Luftwaffe* in the recent hit-and-run raid on this country.

The Ju 188, the existence of which was known for some time, is a low-wing monoplane, with a span of 72ft. 6in., a length of 49ft. and a wing area of 600 sq. ft. It is powered with two B.M.W. 801 14-cylinder twin-row radials, air-cooled and fan assisted, of a power output of 1,530 h.p., each at 20,000ft.

It is of all-metal stressed-skin construction with an undercarriage retracting backwards into the engine nacelles, carrying a crew of four.

The defensive armament is composed of one 20 mm. cannon in the nose, one 13 mm. in upper turret, one 13 mm. in dorsal position and twin 7.9 mm. guns in ventral position, as compared with the two 20 mm. cannons, two 7.9 mm. and two 13 mm. machine guns of the Me 410.

Carrying 640 gallons of fuel and a bomb load of 7,700 lb. at a maximum speed of 325 m.p.h. at 20,000ft., the Ju 188 definitely brings the bomber equipment of the *Luftwaffe* to more up-to-date standards, but it has a formidable foe in the Mosquito which has an ample speed margin to catch it up.

Of the standard German bombers, the Ju 88 and the Me 210 both carry a bomb load of 4,400 lb., and the Me 410, with a speed of about 390 m.p.h. at 22,000ft., carries 2,200 lb. of bombs. Incidentally, reports state that the Me 410 is also equipped with rockets carried underneath the wings.

Acquisition

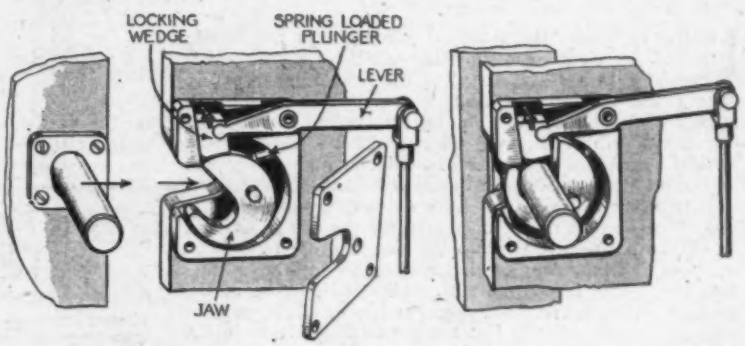
FROM Bucharest it is reported that all stocks of butyric acid and butyl acetate available in Rumania are to be confiscated and placed at the disposal of the Under-Secretary of State for Air.

A New Locking Device

Positive Locking and Quick Release by Direct or Remote Control

THE number of applications for locking devices on both Service and civil aircraft to-day are many, and this type of "gadget" has, therefore, naturally received considerable attention from the design point of view. The introduction by Ingersoll (Eng.), Ltd., of the Ingersoll "Y" Lock adds another useful device which designers may like to incorporate where a really positive lock is essential. It may be quickly released by direct or remote control.

As will be seen from the illustrations, this locking device is a distinct departure from existing lock practice, and considerable ingenuity has been displayed in the design which, due to its extreme simplicity, lends itself to easy and rapid production.



Generally speaking, the usual locking device accomplishes its purpose of holding a moving part or preventing a door from opening, but frequently it fails to make a positive joint between the moving and stationary parts. From the illustrations it will be noted that in this case the cam jaw or hook curls itself around the locking bar, thereby restricting movement in any direction. Rattle or looseness is avoided, and when normally, through constant wear, slackness develops, any such wear in the parts is automatically taken up in this design. In addition, it is claimed that the effect of vibration is to cause added gripping power and holding the locked parts together more tightly. The lock is self-aligning and cannot jam, the hook gripping the locking bar with mechanical precision, and being itself kept immovable by the wedge-shape cam face.

Ingersoll (Eng.), Ltd., claim that their "Y" lock removes all doubts and dangers associated with normal locking devices, thus securing the safety of personnel which frequently may depend upon the efficiency of such devices.

Already in service upon the Miles Master and other purposes connected with service aviation, the principle involved in the design of the lock is such that it can easily be adapted to cover a wide field of uses, such as a glider or target towing hook, parachute equipment release, dinghy or bomb release hook, undercarriage lock, emergency escape hatch lock, drop tank release hook, sliding, folding or hinged door locks, cockpit hoodings, etc. The standard Y.3 pattern has been designed to withstand a load exceeding one ton.

GREEK AIR FORCE

THE Greek Air Force has been reinforced and provided with modern machines and newly trained personnel, the Hellenic News Service has announced.

It is now being employed in purely offensive operations instead of its earlier routine rôle of escorting convoys.

Co-operating with the Allied Air Forces, the statement said, the Greek airmen have shown the same degree of daring and decision which they had shown earlier in the war.

STEAM POWER

ACCORDING to a recent report from America, a steam engine for aircraft has been evolved by Mr. Louis Trosky, a Chicago inventor.

Describing his design's advantages over the petrol engine, Mr. Trosky is recorded as telling the Society of American Military Engineers that he had in his laboratory an engine "designed to give 650 m.p.h. at 50,000ft. with only 400 h.p.," and which would "take any fuel from crude oil to lard."

Other reported claims for the steam-driven aircraft were that it was silent, vibrationless, could take off in a third the distance of a petrol-engined machine, climb at an unthought-of angle, and could be put into large-scale production within nine months.

But the most staggering claim made for this engine—said to be a reciprocating type—is that it could fly round the world without refuelling.

Mr. Trosky has evidently been silent about the really vital part of his steam aircraft engine, namely, its amazingly efficient condenser.

NEW WAR PLANTS "DOWN UNDER"

NEW aircraft to carry up to 8,000 lb. of cargo and industries specially set up in Australia and New Zealand are helping to speed supplies to Allied bases in the Pacific, said Rear Admiral William Brent Young, U.S. Navy, at a recent Press conference in London.

Admiral Young, who is chief of the Bureau of Supplies and Accounts, and has just completed a 24,000 miles flight to the Pacific areas, said that supplies were flowing tremendously to the islands which will be the bases for a push against the Japanese, and conditions would be greatly aided by the development of air transport.

"We are building planes to carry a tremendous weight, up to 8,000 lb. of cargo," he said. "To assist in this we have developed new forms of packing and the hydraulic pressing of supplies. When we have developed these planes we shall use them more and more, especially in the Caribbean.

"Australia and New Zealand have been able to furnish fresh provisions for our fleet, thus saving the long haul across the Pacific which we formerly had.

"They have developed several lines of industry which they have never had before. They have learned, for example, to bone beef and pack it by hydraulic pressing. They have also set up a new industry to furnish members of the Fleet with the candy bars they like so much. And even a plant to provide sauerkraut. They have also helped us with electric gear."

CASTOR SHIMMY

READERS may have been slightly puzzled by the mention of two names in connection with the article by Maj. Marstrand in last week's issue, ascribing, in the introduction to the article under above title, the invention of the twin-contact tyre developed at the Royal Aircraft Establishment and the works of the Dunlop Rubber Co. to Maj. Armstrong. This was an error in transcription and should, of course, have read Maj. Marstrand.

DEATHS

MR. HAROLD HIGGINS, for the past 25 years director and secretary of Yorkshire Engineering Supplies, Ltd., of Leeds, died suddenly on November 4th at the age of 58 years. An associate member of the Institute of Mechanical Engineers and a member of the Institute of Metals, Mr. Higgins was closely associated with the aircraft and motor industries.

* * *

MR. R. M. HANLON has died at the age of 69 after 47 years with Dunlop. During the last war he was technical adviser to the Admiralty on "blimps," the tiny airships used for spotting U-boats round the coast.

Reflector Gun Sights

Two Typical Models for Movable and Fixed Guns Described

IN the old days, the standard gun sight in use in the Royal Air Force was the Ring-and-Bead Sight, which consisted of a central bead in the field of view of the gunner and a concentric ring so arranged as to subtend a fixed angle at the eye. The bead served to indicate the direction in which the guns were pointing whilst the ring formed a standard from which to judge angular allowances and could also be used to estimate the range of the target.

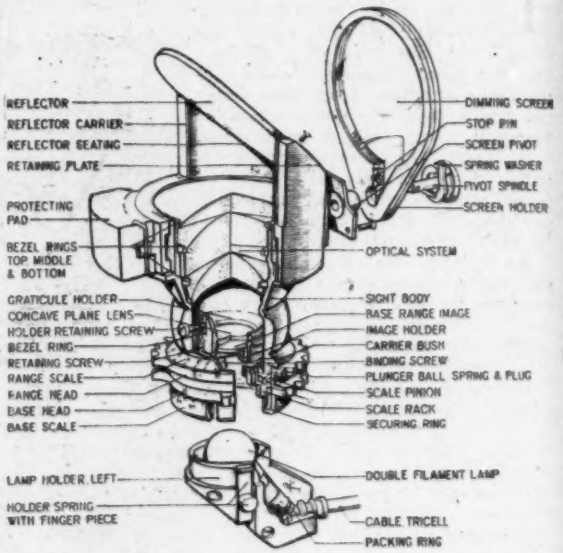
This method of sighting, however, was open to serious objections in that it was necessary for the eye to be held in a fixed position relative to the ring in order to achieve accurate sighting. Any wandering of the eye off the sighting axis resulted in inaccurate aim, whilst the purpose of the ring in subtending a fixed angle at the eye held only so long as the eye remained at a constant distance from the ring.

Free Gun Reflector Sight Mk. IIIA*

To overcome these difficulties, the Reflector Sight was developed. The Free Gun Reflector Sight Mk. IIIA* is a typical sight, which will serve to illustrate the principles involved. As its name implies, it is used with free guns, an installation on a Vickers G.O. gun being shown below.

The sight consists of a diffused monochromatic light source which illuminates a graticule consisting of a translucent ring and bead pattern etched upon an opaque ground, a lens system forming an image of the graticule pattern at infinity (500 yards). A transparent reflector, inclined at 45 deg. to the optical axis and through which the target is viewed, reflects the luminous graticule image which appears superimposed upon the target. A dimming screen consisting of a neutral tinted optical flat for enhancing contrast between the luminous image and bright skies and a hood complete the basic components of the sight.

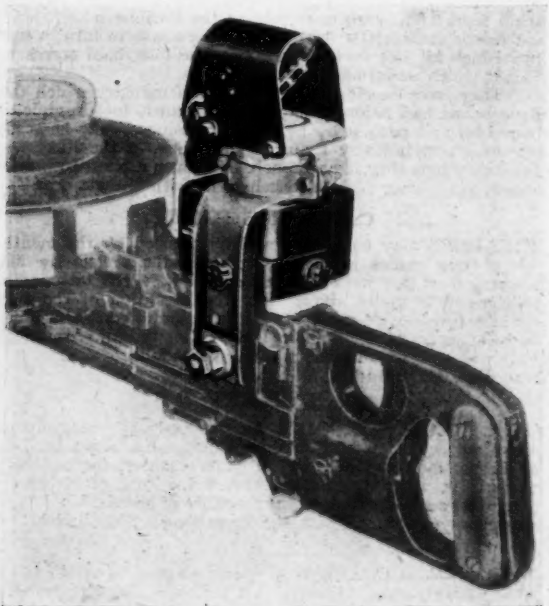
The optical system is contained within a case of moulded plastic or a die-cast box into the base of which is fitted the detachable lamp holder. The outside diameter of the central portion of the body of the optical system is machined spherical to provide, in conjunction with a corresponding socket on the mounting bracket, a mounting which is adjustable for harmonisation.



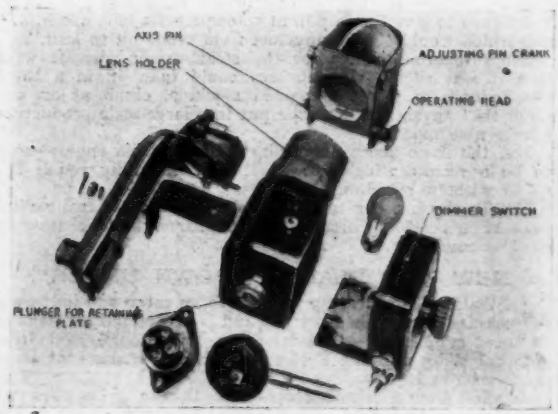
Sectioned drawing of Mark II fixed-gun reflector sight.

The hood, which is mounted on the top of the optical system, carries the reflector and the dimming screen. It also serves a useful purpose in protecting the reflector and optical system from mechanical damage, and protects the graticule from the effects of the sun's rays which would otherwise be focussed on the graticule by the lens system.

The graticule pattern is etched upon an opaque glass disc which is interposed between the graticule lens and the collimating lens system. The diameter of the ring which projected by the optical system on the target plane subtends a constant angle at the eye, its radius representing the correct deflection for a target having an apparent crossing speed of 50 m.p.h. For crossing speeds other than 50 m.p.h., the pilot must mentally construct an imaginary concentric



Mark IIIA* reflector sight fitted to a Vickers K gun.

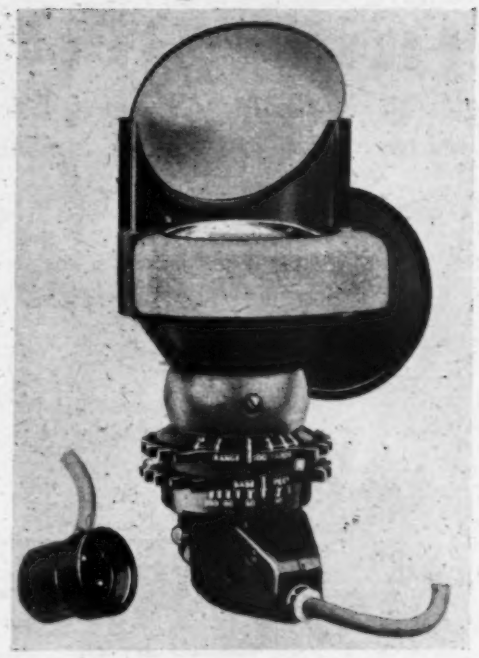


The Mark IIIA* free gun reflector sight dissembled.

ring of the appropriate radius as in normal practice for ring and bead sights.

A disability of the reflector sight is the lack of contrast between the luminous graticule and very bright backgrounds. In such circumstances, therefore, it is necessary to enhance the contrast by interposing a dimming screen between the sight and the target. The dimming screen does not, as might be thought, dim the graticule image, as the image is in fact a virtual image formed by light rays reflected direct from the optical unit to the observer's eye. The interposition of the dimming screen, therefore, dims only the target and background, the graticule image appearing bright by contrast.

To operate the sight, the lamp is switched on and its brightness controlled by a dimmer switch. It is then used in just the same way as the older Ring-and-Bead Sight, with the great advantage that, provided that the sight is correctly focused, small variations of the eye position relative to the sight do not affect its accuracy.



Pilot's Mark II reflector gun sight.

Improving upon the above principles, the Pilot's Reflector Gun Sight Mk. II has been developed. This sight, which is illustrated opposite, is used for fixed gun installations and is, therefore, rigidly attached to the aircraft, usually behind the windscreen and in the line of sight of the pilot. The major differences from the Mk. IIIA* free gun sight described above is that a range estimator is incorporated and the hood is dispensed with.

The optical system is contained within a cast light alloy body, at the upper end of which is mounted the reflector and dimming screen, and at the lower end the detachable lamp holder. As before, the central portion of the body is externally machined spherical in order to provide an adjustable mounting.

The graticule differs in that it is etched on to the flat or lower surface of an opaque concave plane lens and consists of a translucent ring and bead and two cross-wires. The cross-wires are interrupted centrally, the vertical wire stopping short at the ring and the horizontal one extending nearly to the centre, its inner ends being masked to a varying degree by the base/range mechanism. The diameter of the ring when projected on to the target plane subtends a constant angle and its radius represents the correct deflection for a target crossing speed of 100 m.p.h.

Immediately below the graticule is a base/range mask which is rotatable by the range and base heads situated just below the spherical mounting. Rotation of the heads causes the mask to increase or decrease the gap between the two horizontal wires. The setting of the mask is differentially controlled by the two heads, increments of range progressively reducing the gap and increments of base, i.e., apparent span of target, increasing it. The purpose of the range/base mechanism is primarily to obviate the tendency to open fire while still out of effective range; it is not intended to function as a range-finder in the accepted sense.

To operate the sight, the graduation mark on the base head is set to an estimate of the target span based on recognition of the target type and paying due regard to any obliquity of aspect of the target. The range head is set to the range at which it is desired to engage the target and the lamp is then switched on, its brightness being controlled by the dimmer switch. Fire is then withheld while the range closes until the target fills the gap between the horizontal cross-wires.

We are indebted to the Ministry of Aircraft Production for the above notes and illustrations.

RUSSIAN DIVE BOMBER

A PE 2 taxying to the take-off point of Voroshilovgrad airfield. The PE 2 (so named after its designer Petlyakov) is a high-speed light bomber which can be used for either precision or dive bombing.

Fluid Drive

Fundamental Principles of Hydraulic Systems Explained : Possibilities of Future Development Examined

IN the early days of man's conquest of the air the intrepid feats of aviation were performed in relatively simple machines, certainly the pilots were not plagued with the bother of retractable undercarriages, while the low wing loadings inherent in the aircraft of those pioneer days did not necessitate such complications as high-lift devices. As it was, the pilot had to devote all his time to flying his machine, and any diversion of his attention from that object was not welcomed.

However, with the development of aircraft and aviation science, the tendency arose, and still continues, for aircraft to become larger, faster and vastly more complex. The quest for aerodynamic cleanliness introduced retractable undercarriages; high wing loadings necessitate flaps to reduce landing speeds; modern, high-efficiency engines demand accurate temperature control. These, and in the case of military aircraft, many other items, all command a certain amount of the pilot's time, and any system which will effectively provide for their operation with the least attention from the pilot is obviously a large step forward towards making aircraft very much more efficient, more reliable, and consequently safer.

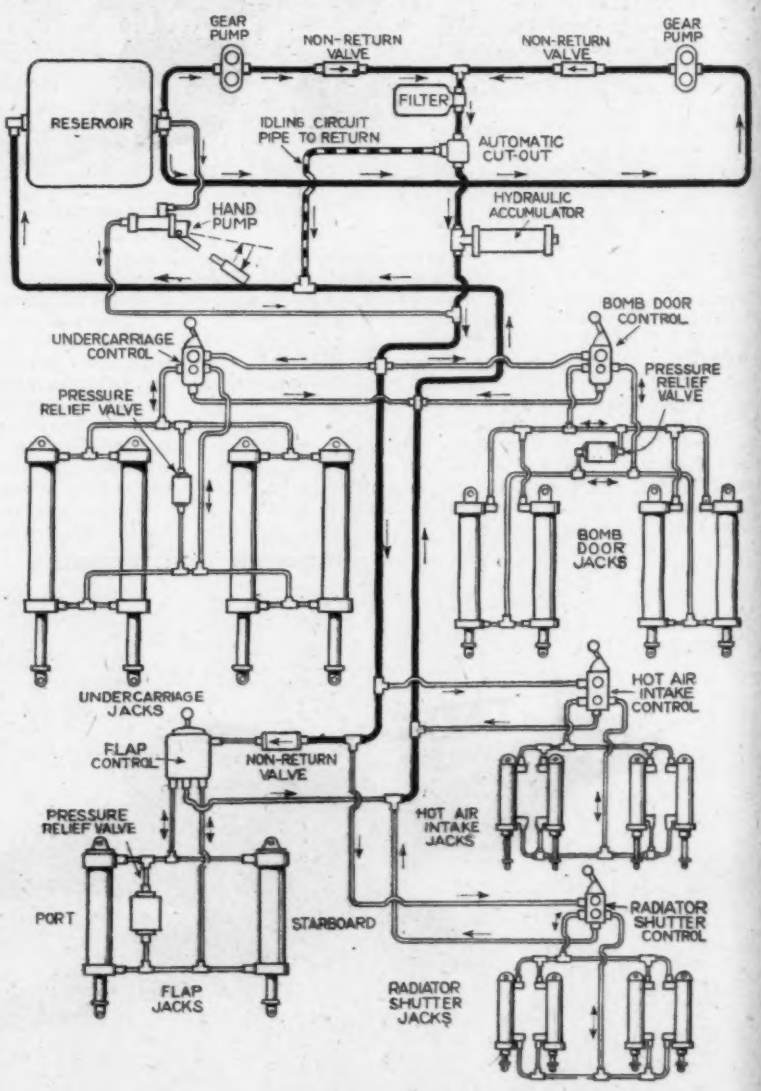
Mechanical Systems

Purely mechanical methods for actuating ancillary services held the field for a short time, but as aeronautical progress marched steadily forward they became rapidly outmoded. Consider the difficulty of operating flaps from the cockpit of a Lancaster by a system of rods, bell-cranks and levers. For a start, the nominal run of the system would be increased by the necessity of avoiding elements of the aircraft structure; all joints and pivot points require lubrication; vibration must be damped; and even if all these factors can satisfactorily be fulfilled, the power input required to overcome static resistance alone would imply an inordinately long lever in the cockpit with concurrently large movement. This is without consideration of the air load on the flaps, rapidity of actuation or the taking up of the pilot's attention at a time when he has his hands full with many other things.

Mechanical systems employing motor power input only alleviate the difficulties by a small amount; weight is of primary importance and motors of sufficient power are not light; clutches, reduction and reversing gears become necessary, with a corresponding increase in weight, maintenance factors and installation difficulties.

The employment of hydraulics was the logical alternative when mechanical systems became too heavy and cumbersome. The almost overwhelming advantages possessed by hydraulics over mechanical means lie in a very wide adaptability to location and application, an extremely flexible operative range, and the fact that no form of mechanical gearing or clutch action is necessary. Wedded to this is virtually instantaneous response, inherent locking, and lightly loaded, simple, remote controls in the cockpit.

The hydraulic system of a four-engined bomber is at first sight itself a complex thing, but basically it is very simple. The bare essentials for any hydraulic system are a reservoir of oil; a pump; control valves; suitable pipe lines; and jacks to operate the desired services. These are primary requirements, but the many additional units incorporated in a heavy bomber system are a function of the number of services actuated. Additionally, all are specifically



Layout of typical hydraulic system for a modern four-engined heavy bomber. The pumps are driven directly from the port and starboard inboard engines, and all the control selector units are mounted conveniently in the cockpit.

FLUID DRIVE

designed to make the system 100 per cent. efficient and almost fully automatic.

Operational flexibility is an integral part of hydraulic systems by virtue of the fundamental principle on which the employment of hydraulics is founded. This is that the load moved by hydraulic force is dependent upon the area of the piston *x* the pressure exerted on the piston. This factor allows a given exerted pressure to move various loads by utilising appropriate jack piston areas. Speed of operation is also dependent upon piston area, the larger the area (to move a given load) the greater the speed of operation.

Thus, although the load in actuating two services (e.g., undercarriage retraction and flap operation) might be 1,000 lb./sq. in., and 200 lb./sq. in. respectively, each can be operated equally effectively by a single power source (pressure)—the result being achieved by using a jack with a piston area of 10 sq. in. for the undercarriage and a jack with a piston area of 2 sq. in. for the flaps. These figures bear no relation to actual values and are used only to illustrate the principle.

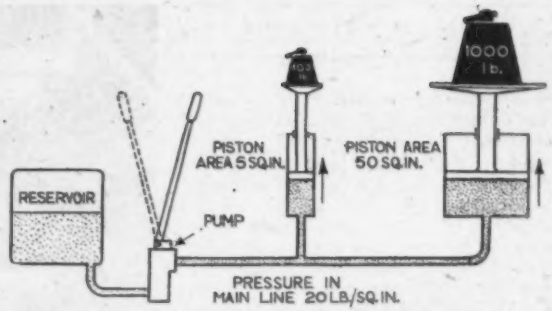
Pumps Do Not Supply Pressure

A commonly held, yet erroneous, view is that pressure is delivered by the pump. A pump delivers a given volume in a given time, but there is no pressure involved. Pressure only occurs when resistance to flow is intruded, the degree of pressure built up depending on the amount of resistance encountered. Thus, fluid pumped through a plain pipe into a bucket will have no pressure (other than from internal resistance), but if the pipe is blocked, pressure is at once created and will rapidly rise until either the pipe bursts or the pressure becomes equal to the power input driving the pump, which will then be forced to a standstill. It is for this reason that pump drive-shafts have a weak spot which will shear at a predetermined overload and prevent damage to the system.

The services operated by hydraulic power in a modern four-engined bomber are usually (i) undercarriage; (ii) bomb doors; (iii) flaps; (iv) radiator shutters or cooling gills; and (v) carburettor hot-air intakes. The operation of gun turrets, landing lights, and the fuel jettison system are also features of some types.

Having seen that the pump merely delivers volume, and that various loads are moved by the same pressure, the adaptation of these principles to useful work is provided by the various units which are incorporated in modern aircraft hydraulic systems.

Reduced to its simplest form, a hydraulic installation consists of a reservoir supplying a pump which delivers oil to a control or selector unit. From this the oil is directed to one side or other of a jack piston in order to extend or contract the jack, and so impart movement to the service to which the jack piston rod is connected. The pressure required to operate the service is built up by the resistance of the jack piston to the oil flow, and when the pressure against the piston overcomes the resistance, the piston moves and operates the service. It is worthy of note that the rate of pressure rise is almost instantaneous, since oil, for the practical application of hydraulic systems, can be considered completely incompressible.



The fundamental principle of hydraulic actuation. A given pressure can move varying loads according to the area of the pistons over which the pressure is exerted.

A typical installation for a four-engined heavy bomber is illustrated. The layout is purely diagrammatic and serves to show only the relative disposition and interconnection of the units; it is in no way intended to represent an actual system.

It is not unusual in the case of large installations (particularly in military aircraft) to employ two pumps, each fitted to one of the aircraft's engines, and in most systems, irrespective of size, a hand-operated pump is also incorporated to act as an emergency pump in the event of engine failure, and to enable routine ground testing to be carried out on the system without the necessity of running the engines.

In the layout illustrated, the twin pumps jointly draw oil from the reservoir and deliver it via non-return valves and a filter to the automatic cut-out. This unit functions as a type of hydraulic clutch; since the pumps are delivering oil the whole time the engines are running—despite the fact that no service may be in operation—some form of clutch effect must be provided.

Whilst no service is in operation the automatic cut-out diverts the flow from the pumps back to reservoir, this being known as an idling circuit, but immediately a service is selected, the cut-out reacts and delivers the full flow from the pumps into the main pressure line from which the various service control units are fed.

Undercarriage leg of Hawker Hurricane showing retraction wells, hydraulic jack, and bracing struts.

Displaced Oil Flow

The whole of the system is completely filled with oil all the time, and when a selection is made and pressure forces a piston along its jack cylinder, the oil on the opposite side of the piston is expelled back through the control unit into the return line to reservoir. As may be seen from the diagram, the main pressure and return lines are subject to flow in one direction only, as are the branch pipes to and from the control units, but the pipes between the jacks and their control units are subject to flow in either direction, according to whether the jacks are being extended or contracted.

The hydraulic accumulator, which is connected into the main pressure line from the automatic cut-out, is incorporated to absorb some of the oil which is fed to the system at a high rate and would otherwise operate the smaller jacks too quickly. Additionally, were no accumulator fitted, the sudden re-

FLUID DRIVE

action of the automatic cut-out and the immediate rapid, large-volume delivery of oil would impose a shock load on the system; this, however, is accommodated by the hydraulic accumulator.

The unit consists essentially of a cylinder divided into two chambers by a free floating piston, one chamber for containing compressed air, the other, oil. The oil chamber is connected into the main pressure line, and when oil is fed from the cut-out, the oil chamber is charged. The introduction of oil into the accumulator forces the piston up the cylinder, so compressing the air and cushioning the shock of delivery.

Another duty performed by the accumulator is the storage of pressure, and when a lightly loaded service (for instance, hot-air intakes) is selected, the jacks are actuated by the pressure stored in the compressed air compartment of the accumulator. If three or four selections of this nature are made, the pressure of the compressed air drops to a value at which the automatic cut-out will react and immediately recharge the accumulator.

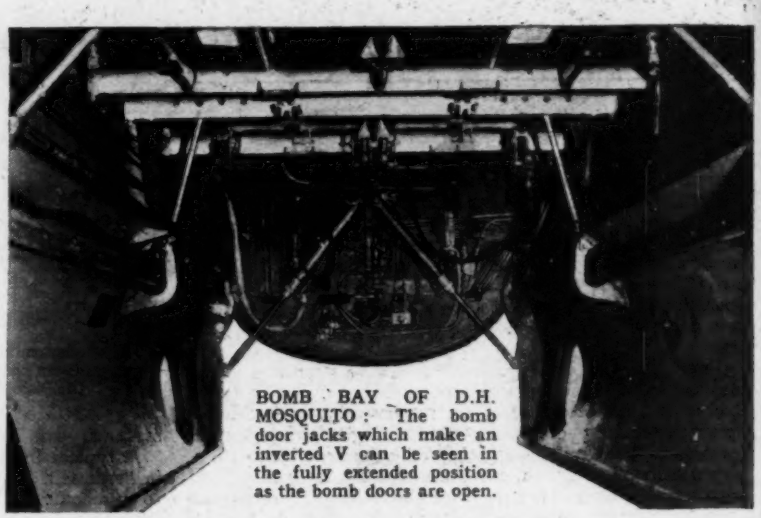
Hydraulic Locking

When all the control unit selector levers are in the neutral position, the valves inside the units are all closed and no oil flow is possible. All the fluid in the system, with the exception of that circulating in the idling circuit, is trapped in the pipe lines and jacks, and is maintained at the reaction pressure of the cut-out. The trapping of the oil between jacks and control units provides a hydraulic lock which holds the jack position secure from movement.

Integral locking of this description allows any service to be held immovable in any position throughout its complete range of travel. Flaps can be locked at any degree of incidence, and radiator shutters and hot-air intakes can be instantaneously adjusted and locked for any required condition of engine operation.

It is possible for excess pressure to be built up by thermal expansion in the oil trapped between various units. Violent fluctuations in atmospheric temperature, such as occur during an aircraft's rapid ascent or descent, affect the density of the oil, an increase in temperature causing the oil to expand and so generate excess pressure. For this reason pressure relief valves are fitted at various points throughout the system; however, the pressure relief valve between the flap jacks supply lines is adjusted to relieve at a much lower figure than the other relief valves, in order to allow the flaps to "blow-up" should the safe airspeed for lowered flaps be exceeded.

This brief description of the salient features of aircraft hydraulic systems is limited to generalities on the main elements of the subject. Consideration of space forbids dealing with the details of components, qualities of fluids, development of automatic actuation, etc.; but an assurance may be given that the application of hydraulics to the aviation world is only at the outset of what promises to be a healthy and lusty career.



BOMB BAY OF D.H. MOSQUITO: The bomb door jacks which make an inverted V can be seen in the fully extended position as the bomb doors are open.

Attempting to foretell the future is an occupation in which man has interested himself for many centuries, and on this precedent a short "preview" of the possible future of hydraulics in aircraft must be considered tenable.

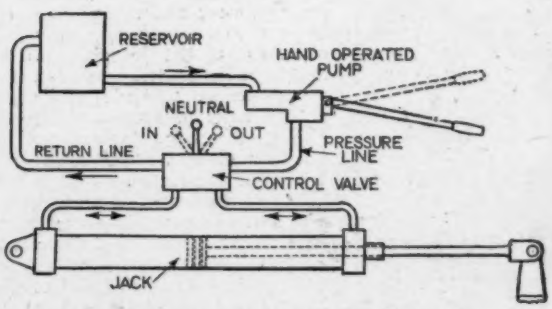
The possibility which first leaps to mind is the application of hydraulics to flight controls. It is almost certain that as aircraft tend to get larger, some form of servo action must be incorporated to assist the muscles of the pilot. The controls of some of the "heavies" to-day are by no means light, and yet every care is exercised in the design offices to ensure that the control linkage or transmission is as smooth, positive and lightly loaded as ingenuity can make it, not to mention the use of aerodynamic balancing of control surfaces to reduce the loads.

Flight Control Loads

Arising from this is the air loading on the control surfaces; broadly speaking, the faster an aircraft is, the smaller its control surface areas need be (pressure x area in a different guise), and the larger angle of deflection allowed for a given result. The large angular movement affords a corresponding reduction in the "stick forces" or loading of the pilot's controls. If the same aircraft were equipped with substantially larger control surface areas, the angular movement of the surfaces could be less for a given result, but the loading on the pilot's controls would be much greater.

A compromise has to be achieved in order to have the control surfaces as small as possible for ordinary flight, yet not so small that control at slow speeds (e.g., landing) is impaired to a serious degree. This is scarcely directly applicable to hydraulics, yet in the consideration of flight control installations it has a definite bearing.

An efficient flight control hydraulic system is not a very difficult thing to design and construct, yet one of the chief opponents to its adoption is the possibility of failure which would leave the pilot with no control over his aircraft. It can be argued (quite reasonably) that failure of a mechanical system would incur equally unpleasant results, and there is no reason why a hydraulic installation, receiving the skilled maintenance and searching inspection given to mechanical systems, should not be fully as reliable in every respect as any other system. This consideration is, of course, for civil aviation. In the case of military aircraft subject to damage from enemy action, hydraulic flight controls might be too vulnerable.



A very simple hydraulic system. The hand-pump delivers oil to the control unit at which selections are made to extend or contract the jack.

THE CASE FOR THE FLYING BOAT

(*Continued from page* 585)

far as British interests are concerned, this demand has very nearly reached its limit. As soon as possible after the war direct non-stop air services between London and New York must be established, but it appears that when this has been done the maximum useful stage for British services will have been achieved. Geographical and traffic considerations indicate a stage of about 3,500 miles as sufficient to cover services linking all parts of the British Commonwealth with each other and with the capitals of other countries. The London-New York stage is approximately 3,450 miles, but an aircraft which can achieve this against the strong North Atlantic winds will have an ample margin in hand for the longest stage of any other route.

With this as the upper limit for range required, the main services over the World routes with which British interests are likely to be concerned fall naturally into three groups, namely, extreme-stage, long-stage and medium-stage. Some of the routes will vary between terminals according to whether the services are operated by flying boats or landplanes, but nearly all the major routes are open as much to the flying boat as to the landplane. In the map British flying boat routes over the World, and the type of service for which each route is suitable are shown.

Summer and Winter

It is not suggested that flying boats would be able to operate the North Atlantic services to Montreal or New York throughout the year, as freezing in occurs in the winter months. During this period the service could be diverted to Bermuda – Baltimore (or Norfolk). Landplane services would not be affected in this way, but on the other hand the direct North Atlantic routes have to pass through the notoriously bad weather zone around Newfoundland, and it may be found desirable to deflect all services to a more southerly route during the worst winter period. For this reason the flying boat should not be ruled out for these direct North Atlantic services. All the other routes are immune from freezing-in conditions and are suitable for flying boat services throughout the year.

Types of Flying Boat Suggested for Development

The types of flying boat which we would suggest for development correspond with the three groups of services set out above.

For Extreme-stage Services.—Provision must be made for a normal effective range of 3,450 miles (London–New York) after allowing for take-off, climb, deviation from course and headwinds. This range is sufficient for the longest stage of any probable British service; for shorter stages fuel can be reduced and payload capacity correspondingly increased. Two alternatives are suggested, namely, Schemes V and VI (these being the serial numbers allocated in the course of our investigations). Both are large six-engine flying boats; Scheme V is essentially a heavy load carrier, while in Scheme VI maximum payload capacity has been sacrificed to obtain higher cruising speed.

For Long-stage Services.—In this case provision is made for a normal range of 2,300 miles with full allowances. For the few stages exceeding 2,300 miles there will be a slight reduction in payload capacity and for the shorter stages a corresponding gain. In this case also two alternatives are suggested, namely, Schemes VIII and X. Scheme VIII is a large six-engine flying boat with high payload capacity and a generous allowance of cubic space per passenger. Scheme X is a four-engine type of more moderate size which may be better related to the traffic available on some of the routes concerned.

For Medium-stage Services.—In this case provision is made for a normal stage of 1,400 miles with full allowances, and again it will be understood that payload capacity will be increased on the shorter stages. The moderate range required does not demand very large size, and the suggested type, Scheme XII, is a four-engine flying boat generally similar to, but smaller than, Scheme X.

Particulars of each of these suggested types, Schemes V, VI, VIII, X and XII, are set out in the table of characteristics. In each case allowance is made for hull pressurising, including the whole of the passengers' and crew's quarters, to a pressure of 5 lb. per sq. in. above outside atmospheric pressure. In each case also the fuel and oil provided covers the range indicated after allowing for take-off, climb to the cruising height, continuous headwind of 50 m.p.h. throughout the stage, and an allowance of 5 per cent. on the stage length for deviation from course.

Recommendations

(i) The first essential is that at least one new design of flying boat should be included in the programme of types for immediate development.

(ii) If only one flying boat design can be included it is recommended that it be one of the larger types suggested, namely, Schemes V, VI or VIII. Any one of these would offer full scope for the development of flying boat design.

(iii) If it should be considered advisable to provide, in the first place, a flying boat of moderate size to meet the requirements of the long-stage services, Scheme X is recommended. This size of flying boat would not be large enough to demonstrate in full the advantages which can be gained as size increases, but it would give good scope for the improvement of flying boat design and would be a very useful general purpose type for British long-stage services all over the world. This type need not be confined, in its application, to long-stage services; it could, of course, be applied to the medium-stage services if and as traffic justified its use.

(iv) If it should be considered that the flying boat can offer its best contribution to British air transport by catering for the medium-stage services, Scheme XII is recommended. This type is of good all-round performance and would be suitable for quick production in the quantities required for such services. It would be a substantial step up in size over pre-war standards, and would give the opportunity of introducing many important advances in design.

BOOK REVIEW

"The Flight Testing of Production Aircraft." By J. A. Crosby Warren, M.A., A.F.R.Ae.S. Sir Isaac Pitman and Sons, Ltd. 8s. 6d.

THERE are dozens, probably hundreds, of pilots to-day who have at the back of their minds the idea that if one is reasonably efficient in flying an aircraft and is of the "let's have a crack at it" mentality, then one is pretty well equipped to undertake test flying. Almost nothing could be farther from the truth.

Mr. Crosby Warren is a test pilot in charge of production flight testing. By the writing of a book setting out so clearly the norm of his work, he proves himself to be more, a man who has a most comprehensive grasp of his subject.

The book is intended mainly for the prospective test pilot, but is very well worthy of study by all those engaged in the flying of aircraft. To say that it is an authoritative work is only a half-truth; it is a live, informative, yet never didactic exposition of a test pilot's duties.

So many technical publications are the mere correlation of a succession of facts. Mr. Crosby Warren has succeeded in writing a technical book in which the reader is treated not to a bare survey, but to what is in effect a personally conducted, informative tour over the whole subject of flight testing.

The author reiterates occasionally that some point or other is beyond the scope of so small a book, but no reader could possibly cavil at the apology. Many aspects of flight testing about which the ordinary pilot never thinks are dealt with, and what is infinitely more important, the reasons for executing the tests are clearly defined.

Testing aircraft—military or civil—necessitates a real, intensive knowledge of and interest in aviation science. Flying ability is almost a secondary requirement. A good test pilot, as the author points out, must be a man of many parts. He must have great patience in learning the causes of faults in aircraft *and all their equipment;* he should possess a sound, practical knowledge of structures, aerodynamics, heat engines, hydraulics, electricity and physics. Primarily he must have a genuine, unaffected interest in the work.

Any man who considers taking up test flying as a career should read this book. Not only does it set forth the work he will have to do, but in the event of his becoming a fledgling test pilot, it gives invaluable "wrinkles" on tracing and counter checking the cause of apparently irreconcilable results.

Ground testing, flight testing, and fault analyses on airframes, engines, ancillary services and equipment are only the bare skeleton on which the body of this book is built, and as pointed out in the introduction: "The author . . . has felt for some time that the knowledge which has been amassed by succeeding generations of test pilots should be recorded both as a text book for the student and as a work of reference for all civilian and R.A.F. test pilots." Crosby Warren has done this job superlatively well.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

THEN AND NOW

Altitude Without Oxygen in 1917-18

I HAVE been interested in films and running commentaries on the radio of aircrew's reactions to conditions produced at 10,000ft., 15,000ft., and 20,000ft. in a sealed room. In 1917 and 1918 we patrolled at 17,000-19,000ft., often for two hours, and sometimes had to fight at that height with little protection from the cold, no heating and no oxygen. I shall be glad to know if the barometric pressure at 17,000ft. in 1943 is less, or if the heart and lung test is less severe?

EX-EXPERIMENTAL PILOT,
R.F.C. and R.A.F.

THEORY OF FLIGHT

Sinking and Forward Speeds

YOUR correspondent (issue November 11th) "Bemused" certainly is. The question comprises two parts. First, one must consider (A) the best gliding angle, and (B) the lowest sinking speed of the aircraft. Weight will not affect the gliding angle, but it will affect the sinking speed. Extra weight will make the aircraft fly faster both horizontally and vertically, but not affect the ratio of these two motions.

The weight of bombs retained would enable the aircraft to penetrate a head wind by extra speed. Secondly, if the aircraft wanted to take advantage of a following wind it would reduce the sinking speed (and its forward speed) to a minimum by jettisoning the load. This would not affect the gliding angle, I repeat, which is the same ratio as the L/D for the whole machine. The weight does not affect the L/D.

As "Bemused" says, air speed and head wind being equal one would descend vertically. Similarly, with sinking speed zero the aircraft would float like the balloon down-wind. So for down-wind travel one needs a low sink, and for up-wind maximum *efficient* forward speed.

Actually there is much more in calculating the best speeds for gliding in winds to attain the maximum distance, and if your correspondent wants to pursue the matter he should look up pre-war copies of the *Sailplane*, where the matter was discussed at some length about 1938. Moreover, the angle of attack need not alter to carry the extra load—the extra forward speed will provide the lift. Let "Bemused" visualise the triangle of forces—Lift, Drag and Weight. If you increase the weight you will increase the others, but the *shape* of the force diagram will remain the same.

Further, these lines will also represent the speeds down the path of flight, sinking and horizontal, and again the angle will not alter but the values will.

J. CECIL RICE, P/O.
O. i/c A.T.C. Gliding School M44.

PACIFIC PERFORMANCES

Influence of Operational Conditions

YOUR correspondents "Puzzled Pair" in the issue dated November 11 have neglected two important factors in their comparison of the Martlet and Buffalo. First, the respective operational conditions under which the two types functioned, and, secondly, the engines with which they were fitted. Although they were both designed in the first place as ship-board fighters for the U.S. Navy and were similarly inferior in performance to equivalent land fighters, the British version of the Martlet was used in this capacity whereas the Buffalo was employed as a land fighter—a job for which it was quite unsuited. The Buffalo used from aircraft carriers of the Royal Navy might have been a success just as the Martlet used as a land fighter in Malaya might have been a dreadful failure.

Secondly, it must be pointed out that the Mk II and III Martlets had the advantage of a two-stage Pratt and Whitney Twin Wasp engine which enabled them to develop their full speed at 17,500 ft., whereas the Cyclone motors of the Buffalo Mk I and III were rated at only 13,000ft., above which the power and speed fell off rapidly. The Cyclone-powered Martlet, Mk I and IV, was not so widely used as the Twin Wasp version, and most of the operational successes in the Mediterranean area were scored by Mk II and III Martlets. Similarly, the U.S. Navy F_4F 3 and F_4F 4 Wildcats, which were so successful against the Japanese in the Pacific, were mostly fitted with the Twin Wasp instead of the Cyclone. Royal Navy Martlets which operated as land fighters in the Western Desert at one period were able to do so because of their Twin Wasp motors; the Cyclone Martlet would have been no use.

The Buffalo was tested as a land fighter in 1940 by British fighter pilots and U.S. Eagle Squadron pilots in this country and found wanting, and its use in the Far East can be attributed to the fact that the existence of such Japanese aircraft of the calibre of the Mitsubishi S-00 was unknown to the higher authorities concerned in the defence organisation. British-built fighters were badly needed both at home and in Africa at the time, and the supplies of Buffaloes from America were, to all intents and purposes, a Godsend.

OWEN G. THETFORD.

[Another important factor was the Martlet's superior rate of climb.—ED.]

BOMBER ARMAMENT

Leave Things as They Are

I HAVE read with interest the previous correspondence in *Flight* about bomber armament, and feel I should like to criticise the correspondence, at the same time adding views of my own.

"Perspex" seems to forget (when he proposes flying in formation, with the bombers with no armament inside, and the converted bombers outside, acting as fighters) the difficulty of flying in formation on pitch-dark nights for a couple of thousand miles. I should think it is impossible. It is not such a bad idea in daylight, except for the fact that should the fighters get parted from the bombers—and they might—there would be massacre among the bombers. After all, remember what our fighters did to the German bombers once their fighter rings were broken up.

"Young Spotter" seems to think that because the Americans use 0.5in. machine guns we ought to adopt them. Surely one only has to remember the dive-bomber to see that the American ideas do not always work well. Furthermore, I think that the R.A.F. has had a lot more experience to back up the men who decide what guns to use than have the Americans.

To summarise, then, I think that bombers ought to be left versatile, like the Halifax, Stirling, Lancaster, etc., so they can fight their own battles. The R.A.F. has found from past experience that specialisation in aircraft is more trouble than it is worth, and we are not doing so badly just as we are.

Remember, a war cannot be won without losses.

"X."

Destroyer Screens in Daylight Only

I FEEL I have a reasoned argument with "Perspex" against the feasibility of his project with regard to night bombing.

First, I think the idea of a large formation of bombers flying in close proximity to each other over enemy country at night without the aid of formation lights is suicide. The risk of collision would be very great, and the task of the ground defences would be very much simplified.

Another aspect when considering a heavily armed Stirling, carrying no bombs, firing a long burst from several 0.5in. or 20 mm. calibre guns at night is the glare caused. Momentary though this may be, I think it would be sufficient to betray the exact position of the aircraft or formation to enemy fighters.

I think the primary function of the night bomber is undoubtedly to bomb and not to fight.

Chances of interception at night are greatly reduced when aircraft fly singly. This gives some justification to light armament being used.

My own regret with this in mind is that our night bombers are not more streamline in shape so that the power available could be more efficiently used when evasive action becomes necessary.

With regard to daylight raids on distant targets, the heavily armed four-engined aircraft flying as a destroyer screen for the bombers seems feasible—in fact, quite a good idea.

J. BUTTELL.

Gas Turbines and Jet Propulsion for Aircraft
By G. GEOFFREY SMITH, M.B.E.
A second edition of the above booklet is now available from "Flight" publishing offices. The new work consists of ten chapters and includes many illustrations. Price 3/6 plus 3d. post.

INDEPENDENCE : A Czech fighter squadron of Spitfires saluting President Benes at a parade celebrating the 25th anniversary of the Czecho-Slovak Republic.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Promotion

GENERAL DUTIES BRANCH.

Air Comdre. A. B. ELWOOD, D.S.C., is granted the rank of Air Vice-Marshal, January 25th, 1943.

Awards

Far East

THE KING has been graciously pleased, on the advice of the Australian Ministers, to approve the following appointments and awards in recognition of conspicuous service in operations against the Japanese :—

C.B.E. (Mil.)

Group Capt. W. H. GARING, D.F.C., R.A.A.F.

Distinguished Service Order

Act. Wing Cdr. C. R. CALDWELL, D.F.C., R.A.A.F.
Sqn. Ldr. D. VERNON, R.A.A.F.

O.B.E. (Mil.)

Act. Sqn. Ldr. T. M. SCOTT, R.A.A.F.

M.B.E. (Mil.)

F/O. R. G. BEATON, R.A.F.

Distinguished Flying Cross

Wing Cdr. K. R. J. PARSONS, R.A.A.F.
Wing Cdr. J. M. WHYTE, R.A.A.F.
Sqn. Ldr. G. W. SAVAGE, R.A.A.F.
Flt. Lt. P. McC. PAULL, R.A.A.F.
Flt. Lt. R. H. ROE, R.A.A.F.
Act. Flt. Lt. H. TAMBLYN, R.A.F.V.R.
F/O. H. G. McM. BROWN, R.A.A.F.
F/O. P. P. A. HOPTON, R.A.A.F.
F/O. J. T. KEARNEY, R.A.A.F.
F/O. K. N. McDONALD, R.A.A.F.
F/O. F. J. MAGEE, R.A.A.F.
F/O. J. N. MARR, R.A.A.F.

Air Force Cross

Sqn. Ldr. G. H. PURVIS, R.A.A.F.

Distinguished Flying Medal

Sgt. E. J. C. BARNETT, R.A.A.F.
Sgt. D. A. FERME, R.A.A.F.
Sgt. H. A. KIRKHOUSE, R.A.A.F.
Sgt. M. C. SCHULZ, R.A.A.F.
Act. Sgt. R. F. COX, R.A.A.F.
Cpl. J. P. L. D'ARCY, R.A.A.F.
Cpl. V. N. KNOWLES, R.A.A.F.
Cpl. J. A. McWADE, R.A.A.F.

B.E.M. (Mil.)

Flt. Sgt. J. INGERSOLE, R.A.A.F.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy :—

Distinguished Service Order

Act. Wing Cdr. P. BURNETT, D.F.C., R.A.F.O., No. 9 Sqn.—Wing Cdr. Burnett is an ideal leader, whose untiring efforts and personal example have been reflected in the high standard of operational efficiency of the squadron he commands. He has taken part in many sorties against important enemy targets and throughout has displayed great skill and tenacity. On one occasion in September, 1943, when nearing base, on the return flight from Hanover, his aircraft was damaged by machine gun fire from an enemy fighter. Two engines were put out of action but the airfield was reached. When coming in to land, a third engine failed, but, in spite of this, Wing Cdr. Burnett effected a safe landing without the aid of the flaps which had also been damaged.

Lt. Cdr. A. Paterson, R.N., Air Staff Officer of the aircraft carrier H.M.S. *Attacker*.

Act. Wing Cdr. E. W. DEACON, D.F.C., R.A.F., No. 35 Sqn.—One night in September, 1943, this officer piloted an aircraft detailed to attack Montlucon. Wing Cdr. Deacon executed his task with great skill in spite of adverse weather, bombing his target with great precision from a low level.

Flt. Lt. C. F. RAWNSLEY, D.F.C., D.F.M., R.A.F.V.R., No. 85 Sqn.—As observer, Flt. Lt. Rawnsley has participated in more than 200 sorties and his brilliant work has been beyond praise. He has assisted in the destruction of 17 enemy aircraft, 16 of them at night. In addition to his work in the air, Flt. Lt. Rawnsley has devoted much service towards the training of other members of aircraft crew and his efforts have been attended with excellent results.

F/O. D. M. JOHNSTONE, R.A.F.V.R.—This officer and airmen were members of the crew of an aircraft engaged on an anti-submarine patrol in September, 1943. During the flight the aircraft was engaged by four Ju. 88s. The captain was killed in the early stages of the combat and Flt. Sgt. Foss, the second pilot, immediately took over the controls. F/O. Johnstone, with commendable initiative, immediately went to his assistance and rendered material help in subsequent evading tactics. The enemy pressed home their attack, however, and the aircraft was extensively damaged and caught fire, while several of the crew were wounded. Although the aircraft was fast becoming uncontrollable, Flt. Sgt. Foss and F/O. Johnstone, by a combined effort, succeeded in bringing the aircraft down on to the sea where it became wrecked on impact with the water. Although under water, F/O. Johnstone, who was himself injured, gallantly assisted two of his wounded comrades to get clear by allowing them to step on his shoulders and head and thus to scramble through a gaping hole in the submerged portion of the aircraft. Meanwhile, Flt. Sgt. Foss assisted other members of the crew into the dinghy. For nine days, these members of aircraft crew were adrift, and during this period F/O. Johnstone, Flt. Sgt. Foss and Sgt. Dilks displayed great courage and high morale.

F/O. R. W. CLEAVER, R.A.F.V.R., No. 295 Sqn.—In July, 1943, this officer was detailed to tow a glider, laden with troops, to take part in the invasion of Sicily. While still 100 miles from his target, his aircraft caught fire. Displaying the utmost determination, he continued to tow the glider and at the same time succeeded in extinguishing the flames. By this time, much height had been lost and the aircraft was only 500 feet above the sea. In consequence all spare equipment had to be jettisoned, and it was impossible to release the glider at the correct distance from land. F/O. Cleaver therefore continued to tow the glider a considerable distance

inland in the face of anti-aircraft fire and searchlights, thus enabling it to land at the correct place. After releasing the glider, he flew his damaged aircraft to base and made a safe landing. This operation was the culminating point of continuous ferrying missions completed by this officer.

Act. Wing Cdr. J. J. McKAY, D.F.C., R.A.F., No. 178 Sqn.—This officer has proved to be a most capable commanding officer throughout a period when many difficulties were encountered and the squadron was operating in an isolated situation in the desert. At one time, Wing Cdr. McKay took part in several consecutive operations with keenness and determination.

Act. Sqn. Ldr. W. R. KOFOED, D.F.C., R.N.Z.A.F., No. 462 Sqn.—This officer has already completed a tour of operations against objectives in Europe and the Middle East. During his second tour of duty he has attacked such targets as Palermo and Catania, and has taken part in flights over the battle areas in the Tunisian campaign. On one sortie over Palermo, a photo-flash exploded in the fuselage of his aircraft which was badly damaged. By superb handling, however, Sqn. Ldr. Kofoed flew his aircraft safely to base—a flight of eight hours' duration.

Act. Flt. Lt. D. MARROWS, D.F.C., R.A.A.F., No. 461 (R.A.A.F.) Sqn.—As pilot and air gunners respectively, this officer and airmen have undertaken many sorties and have displayed great skill and devotion to duty throughout. On a recent occasion, whilst flying over enemy waters, their aircraft was intercepted by six Ju. 88s. In the ensuing engagement, Flt. Lt. Marrows fought with great skill and determination. Well supported by his gunners he frustrated the attackers for more than an hour until, with three engines shot away and all but one gun silenced, he was forced to bring his aircraft down on to the water. Although a heavy sea was running the crew succeeded in getting aboard the one remaining dinghy. During the action Sgt. Bamber had been badly wounded, but, whilst in the dinghy, set a fine example of cheerfulness and resolution until a rescue was subsequently effected. Throughout this spirited action Flt. Lt. Marrows displayed inspiring leadership, great courage and determination; Sgt. Pearce also fought with rare zest and subsequently displayed coolness and resource when the aircraft had to be abandoned.

Act. Wing Cdr. M. HODGES, D.F.C., R.A.F., No. 161 Sqn.—Since being awarded a Bar to the D.F.C., this officer has undertaken many sorties. The successes obtained reflect the greatest credit on the efforts of Wing Cdr. Hodges, whose efficiency and personal example, both in the air and on the ground, have been outstanding.

Act. Flt. Lt. J. A. BROADLEY, D.F.C., D.F.M., R.A.F., No. 161 Sqn.—Flt. Lt. Broadley is a navigator of exceptional merit. He has completed a large number of sorties, rendering most valuable service, and his efforts have contributed materially to the successes achieved.

Bar to Distinguished Flying Cross

Flt. Lt. W. C. E. CRAIG, D.F.C., R.A.F., No. 462 Sqn.—Flt. Lt. Craig is deputy commander of a flight in this squadron and in that capacity has shown himself to be an able leader and a sound organiser. On his first operational tour, in the Middle East, he completed a number of outstanding night bombing attacks on such targets as Benghazi, Tobruk and Tripoli, while on his second tour he has continued to display undiminished ardour for operational work.

Act. Wing. Cdr. W. H. SHAW, D.F.C., R.A.F.O., No. 83 Sqn.—Since being awarded the D.F.C. this officer has undertaken many sorties, including attacks on such targets as Berlin, Turin, Genoa. On August 27th, 1943, he participated in an operation against Nuremburg when he pressed home a determined attack and obtained excellent photographic evidence of his work. Wing Cdr. Shaw has displayed great zest for operations, and his example of determination and devotion to duty has been most commendable.

Act. Sqn. Ldr. N. F. HILDYARD, D.F.C., R.A.F.V.R., No. 8 Sqn.—This officer has completed very many sorties since being awarded the D.F.C. On a recent occasion he piloted an aircraft detailed to attack Nuremburg. During the bombing run the aircraft was illuminated by the searchlights, but, after several minutes, Sqn. Ldr. Hildyard flew clear and executed another run over the target which was bombed with accuracy. This officer has displayed great skill and unfailing devotion to duty.

Act. Flt. Lt. J. F. HACKING, D.F.C., R.A.F.V.R., No. 83 Sqn.—Flt. Lt. Hacking is a navigator of exceptional skill, whose brilliant work has contributed in a large measure to the successful bombing of many important enemy targets. In addition to his successes in the air, Flt. Lt. Hacking has devoted his energies towards the training of many navigators of the squadron. This officer has set a most praiseworthy example.

Act. Flt. Lt. H. P. MASON, D.F.C., R.A.A.F., No. 83 Sqn.—This officer, who has completed a very large number of sorties, has displayed high qualities of leadership and outstanding skill. His unfailing determination was amply demonstrated during a recent operation against Berlin, when, in the face of heavy opposition, he pressed home his attack with great accuracy. Flt. Lt. Mason has set a very fine example.

Act. Sqn. Ldr. J. L. W. WAGLAND, D.F.C., R.A.F.V.R.—This officer has undertaken a large number of sorties, and his navigational ability throughout has been outstanding. On two occasions in September, Sqn. Ldr. Wagland participated in sorties which demanded skill and determination of a high order. In addition to his good work in the air, Sqn. Ldr. Wagland has rendered excellent service in the training of other members of aircraft crew.

SERVICE AVIATION

Act. Flt. Lt. F. A. AIKMAN, D.F.C., R.C.A.F., No. 154 Sqn.—Flt. Lt. Aikman is a keen and tenacious fighter. He has destroyed at least eight enemy aircraft. He has shown a rare zest for battle.

Distinguished Flying Cross

Act. W/O. (now P/O.) R. F. DENTON, R.A.F.V.R., No. 90 Sqn. For citation see Sgt. Jones, C.G.M.
Act. Flt. Lt. O. L. BROWNE, R.A.F.V.R., No. 158 Sqn.
Act. Flt. Lt. L. H. BUTLER, R.N.Z.A.F., No. 149 Sqn.
Act. Flt. Lt. D. M. CAREY, R.C.A.F., No. 103 Sqn.
Act. Flt. Lt. E. B. CHANDLER, R.A.F.V.R., No. 49 Sqn.
Act. Flt. Lt. W. H. CHEEK, R.A.F., No. 90 Sqn.
Act. Flt. Lt. M. E. CHIVERS, R.A.F.V.R., No. 61 Sqn.
Act. Flt. Lt. P. F. CLAYTON, R.A.F.V.R., No. 97 Sqn.
Act. Flt. Lt. C. W. COLE, R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.
Act. Flt. Lt. L. C. DILWORTH, R.C.A.F., No. 429 Sqn.
Act. Flt. Lt. A. C. DOWDEN, R.A.F.V.R., No. 78 Sqn.
Act. Flt. Lt. K. EGGLESTON, R.A.F.V.R., No. 115 Sqn.
Act. Flt. Lt. R. ELLIS-BROWN, R.A.F.V.R., No. 214 Sqn.
Act. Flt. Lt. S. G. FALCONER, D.F.M., R.A.F.V.R., No. 214 Sqn.
Act. Flt. Lt. D. W. FINLAY, R.A.F.V.R., No. 103 Sqn.

(Left) Flt. Lt. D. R. Morrison, D.F.C., D.F.M., and (right) Flt. Lt. Dougall, D.F.C. Both are repatriated prisoners of war and have been decorated at Buckingham Palace by the King.

Act. Flt. Lt. R. A. FLETCHER, D.F.M., R.A.F.V.R., No. 97 Sqn.
Act. Flt. Lt. W. A. G. GALLIENNE, R.A.F.V.R., No. 83 Sqn.
Act. Flt. Lt. R. E. GARDINER, R.A.F.V.R., No. 12 Sqn.
Act. Flt. Lt. T. W. HARRIS, R.A.F.V.R., No. 408 (R.C.A.F.) Sqn.
Act. Flt. Lt. A. N. HOLLIS, R.A.F.V.R., No. 50 Sqn.
Act. Flt. Lt. W. E. HULL, R.A.F.V.R., No. 101 Sqn.
Act. Flt. Lt. H. L. HULME, R.A.F.V.R., No. 35 Sqn.
Act. Flt. Lt. W. N. KEDDIE, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
Act. Flt. Lt. L. KERR, R.A.F.V.R., No. 158 Sqn.
Act. Flt. Lt. W. J. KLUFAS, R.C.A.F., No. 15 Sqn.
Act. Flt. Lt. E. F. LEWIN, R.A.F.V.R., No. 7 Sqn.
Act. Flt. Lt. H. B. LOCKE, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
Act. Flt. Lt. D. H. LUCK, R.A.F., No. 83 Sqn.
Act. Flt. Lt. A. L. MCGRATH, R.N.Z.A.F., No. 156 Sqn.
Act. Flt. Lt. L. L. MCLEOD, R.A.A.F., No. 408 (R.C.A.F.) Sqn.
Act. Flt. Lt. A. R. MIDDLETON, R.A.F.V.R., No. 102 Sqn.
Act. Flt. Lt. S. M. G. PERYER, R.N.Z.A.F., No. 90 Sqn.
Act. Flt. Lt. H. E. T. PRAGER, R.A.F.V.R., No. 115 Sqn.
Act. Flt. Lt. B. F. RAWSON, R.C.A.F., No. 429 Sqn.
Act. Flt. Lt. J. E. R. RAWSTORNE, R.A.F.V.R., No. 103 Sqn.
Act. Flt. Lt. K. H. REYNOLDS, R.A.F., No. 158 Sqn.
Act. Flt. Lt. H. G. M. ROBINSON, R.A.A.F., No. 76 Sqn.
Act. Flt. Lt. H. W. SANDGREN, R.C.A.F., No. 158 Sqn.
Act. Flt. Lt. F. E. SHEPPARD, R.A.F.V.R., No. 90 Sqn.
Act. Flt. Lt. F. STANYARD, R.A.F.V.R., No. 158 Sqn.
Act. Flt. Lt. D. L. C. THOMAS, R.A.F.V.R., No. 61 Sqn.
Act. Flt. Lt. C. H. T. TUBMAN, R.A.F.V.R., No. 427 (R.C.A.F.) Sqn.
Act. Flt. Lt. G. R. WHITTEN, R.A.F.V.R., No. 35 Sqn.
Act. Flt. Lt. R. E. WILKINSON, R.A.F.V.R., No. 158 Sqn.
F/O. M. R. ASHMAN, R.A.F.V.R., No. 77 Sqn.
F/O. A. G. BADMAN, R.A.F.V.R., No. 101 Sqn.
F/O. W. A. C. BOWEN, R.A.F.V.R., No. 115 Sqn.
F/O. J. CAFFERTY, R.A.F.V.R., No. 76 Sqn.
F/O. E. T. CAPPI, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. M. W. P. CARRECK, R.A.F.V.R., No. 192 Sqn.
F/O. R. H. CHADWICK, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.
F/O. R. K. CLARK, R.C.A.F., No. 61 Sqn.
F/O. W. R. CLOW, R.C.A.F., No. 51 Sqn.
F/O T. B. COOPER, R.A.F.V.R., No. 101 Sqn.
F/O. A. S. DREW, R.N.Z.A.F., No. 156 Sqn.
F/O. G. B. ELLWOOD, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. G. W. FAIRWEATHER, R.A.F.V.R., No. 106 Sqn.
F/O. H. L. FORREST, R.C.A.F., No. 196 Sqn.
F/O. W. S. GAUNT, R.A.F.V.R., No. 466 (R.A.A.F.) Sqn.
F/O. T. W. GIRDLESTONE, R.A.F.V.R., No. 12 Sqn.
F/O. C. W. GRAY, R.A.F.V.R., No. 50 Sqn.
F/O. K. G. GRAY, R.C.A.F., No. 207 Sqn.
F/O. E. G. HARDINGHAM, R.A.F.V.R., No. 12 Sqn.
F/O. F. S. HAIR, R.A.F.V.R., No. 419 (R.C.A.F.) Sqn.
F/O. G. G. HURST, R.A.F.V.R., No. 218 Sqn.
F/O. D. H. JONES, R.A.A.F., No. 102 Sqn.
F/O. A. A. MACFARLANE, R.N.Z.A.F., No. 466 (R.A.A.F.) Sqn.
F/O. I. MACLEAN, R.A.F.V.R., No. 138 Sqn.
F/O. F. A. MARGETTS, R.A.F.V.R., No. 10 Sqn.
F/O. A. M. MCDONALD, D.F.M., R.A.A.F., No. 102 Sqn.
F/O. M. MCIVER, R.C.A.F., No. 106 Sqn.
F/O. A. G. MILES, R.A.F.V.R., No. 61 Sqn.
F/O. J. E. H. MORRIS, R.A.A.F., No. 76 Sqn.
F/O. T. E. OSBORN, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. R. W. PALMER, R.C.A.F., No. 50 Sqn.
F/O. J. J. PATTINSON, R.A.F.V.R., No. 90 Sqn.
F/O. E. H. RAFFERTY, R.A.A.F., No. 10 Sqn.
F/O. P. ROBINS, R.A.F.V.R., No. 57 Sqn.
F/O. H. J. ROGERS, R.A.F.V.R., No. 35 Sqn.
F/O. N. D. SAMUEL, R.A.F.V.R., No. 166 Sqn.
F/O. M. SATTLER, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. H. K. SHIELD, R.N.Z.A.F., No. 149 Sqn.
F/O. D. S. SMART, R.C.A.F., No. 77 Sqn.
F/O. B. H. STANLEY, R.A.F.V.R., No. 35 Sqn.
F/O. P. A. STEVENS, R.A.A.F., No. 156 Sqn.
F/O. M. H. STEWART, R.A.F.V.R., No. 12 Sqn.
F/O. A. G. TAYLOR, R.A.F.V.R., No. 10 Sqn.
F/L. J. D. VIAZEY, R.A.F.V.R., No. 466 (R.A.A.F.) Sqn.
F/O. W. WEISER, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. F. J. WRIGHT, R.A.F.V.R., No. 12 Sqn.
F/O. J. H. WRIGHT, R.A.F., No. 156 Sqn.
F/O. W. A. YENDELL, R.A.F.V.R., No. 10 Sqn.
P/O. R. H. DAVIES, R.A.F.V.R., No. 24 (S.A.A.F.) Sqn.
Flt. Lt. N. BOWKER, R.A.F.V.R., No. 112 Sqn.
Flt. Lt. R. A. LENTON, M.C., R.A.F., No. 540 Sqn.
Flt. Lt. F. A. MONTFORD, R.A.F.V.R., No. 58 Sqn.
Flt. Lt. W. J. G. MORGAN, A.A.F., No. 540 Sqn.
Flt. Lt. D. M. RYAN, R.A.F.V.R., No. 210 Sqn.
Flt. Lt. C. S. WEST, R.A.F., No. 190 Sqn.
Act. Flt. Lt. T. BROWN, R.A.A.F., No. 10 (R.A.A.F.) Sqn.
Act. Flt. Lt. D. MARROWS, R.A.A.F., No. 461 (R.A.A.F.) Sqn.
Act. Flt. Lt. A. D. ANDREW, R.A.F.V.R., No. 51 Sqn.
Act. Flt. Lt. H. J. BARLEY, R.A.F.V.R., No. 44 Sqn.
Act. Flt. Lt. R. H. COCHRANE, R.C.A.F., No. 218 Sqn.
F/O. K. F. DACRE, R.A.F.V.R., No. 605 Sqn.
F/O. L. W. PILGRIM, R.A.F.V.R., No. 44 Sqn.
F/O. S. W. R. WILHEMSON, R.C.A.F., No. 192 Sqn.
P/O. H. ROGERS, R.A.F.V.R., No. 44 Sqn.
Act. Sqn. Ldr. C. P. N. NEWMAN, R.A.F., No. 34 Sqn.
Flt. Lt. K. S. JENNER, R.N.Z.A.F., No. 159 Sqn.
Flt. Lt. G. L. A. MCKENNY, R.A.F.V.R., No. 462 Sqn.
F/O. H. M. FULLER, R.A.A.F., No. 104 Sqn.
F/O. A. H. GUNN, R.A.F.V.R., No. 680 Sqn.

Conspicuous Gallantry Medal (Flying)

Flt. Sgt. R. J. ROSS, R.A.F.V.R., No. 224 Sqn. For citation see F/O. Johnstone, D.S.O.

Sgt. O. N. JONES, R.A.F.V.R., No. 90 Sqn.—In September, 1943, W/O. Denton and Sgts. Jones and Suddens were pilot, flight engineer and navi-

gator respectively of an aircraft detailed to attack Hanover. Just after the bombs had been released the aircraft was intercepted by a Ju. 88 which made several attacks. The bomber was repeatedly hit and sustained much damage. The rear gunner was killed, while W/O. Denton was hit in the leg by a bullet and Sgt. Suddens was wounded in the hand. Nevertheless W/O. Denton succeeded in flying clear and set course for this country. Meanwhile, Sgt. Jones, displaying praiseworthy promptitude, dealt effectively with two fires, afterwards rendering first aid to his wounded comrades. In face of many difficulties, W/O. Denton succeeded in reaching this country and successfully crash-landed the damaged bomber at an airfield. Throughout the return flight Sgts. Jones and Suddens did everything within their power to assist and proved themselves cool and resourceful members of aircraft crew.

Distinguished Flying Medal

Sgt. F. BAMBER, R.A.A.F., and Sgt. A. N. PEARCE, R.A.A.F., both of No. 461 (R.A.A.F.) Sqn. For citation see Flt. Lt. MARROWS, D.S.O., D.F.C.

Sgt. M. W. DILKS, R.A.F.V.R., No. 224 Sqn.—For citation see F/O. Johnstone, D.S.O.

Sgt. R. W. G. SUDDENS, R.A.F.V.R., No. 90 Sqn. For citation see Sgt. JONES, T.G.M.

Flt. Sgt. K. L. HASLAM, R.A.F., No. 34 Sqn.

Flt. Sgt. J. WILKINSON, R.A.F.V.R., No. 104 Sqn.

Sgt. R. MARSDEN, R.A.F., No. 462 Sqn.

Sgt. W. J. SPENCER, R.A.F.V.R., No. 462 Sqn.

Flt. Sgt. R. B. HICKS, R.C.A.F., No. 83 Sqn.

Flt. Sgt. P. MENZIES, R.N.Z.A.F., No. 83 Sqn.

Flt. Sgt. J. W. SLAUGHTER, R.A.F.V.R., No. 83 Sqn.

Flt. Sgt. A. W. J. HAZELL, R.A.F.V.R., No. 236 Sqn.

Flt. Sgt. W. Y. RICHARDSON, R.A.A.F., No. 254 Sqn.

Flt. Sgt. C. A. KIRKHAM, R.A.F.V.R., No. 76 Sqn.

Sgt. H. G. FOSTER, R.A.F.V.R., No. 76 Sqn.

Sgt. A. B. WARD, No. 76 Sqn.

Sgt. K. J. BAKER, R.A.F.V.R., No. 15 Sqn.

Sgt. A. V. RIPPENGAL, R.A.F.V.R. No. 40 Sqn.

Sgt. H. BENNETT, R.A.F., No. 100 Sqn.

Flt. Sgt. A. McL. CLARK, R.A.A.F., No. 104 Sqn.

Flt. Sgt. B. I. J. MORRIS, R.A.F.V.R., No. 40 Sqn.

Sgt. P. J. HATWARD, R.A.F.V.R., No. 40 Sqn.

Sgt. J. H. MALLAN, R.A.F.V.R., No. 467 (R.A.A.F.) Sqn.

Act. Flt. Sgt. A. L. AARON, R.A.F.V.R., No. 218 Sqn.

Act. Flt. Sgt. J. C. BAXTER, R.A.F.V.R., No. 156 Sqn.

Act. Flt. Sgt. C. H. LAWRENCE, R.A.F.V.R., No. 156 Sqn.

Act. Flt. Sgt. J. P. MEDDINGS, R.A.F.V.R., No. 83 Sqn.

Act. Flt. Sgt. E. J. WHITE, R.A.F.V.R., No. 97 Sqn.

Sgt. G. H. AGAR, R.A.F.V.R., No. 103 Sqn.

Sgt. G. AITKEN, R.A.F.V.R., No. 103 Sqn.

Sgt. C. T. AMBROSE, R.A.F.V.R., No. 97 Sqn.

Sgt. W. J ATKINS, R.A.F.V.R., No. 61 Sqn.

Sgt. P. G BARBY, R.A.F.V.R., No. 467 (R.A.A.F.) Sqn.

Sgt. D. BOOTH, R.A.F.V.R., No. 467 (R.A.A.F.) Sqn.

Sgt. G. BREAKWELL, R.C.A.F., No. 76 Sqn.

Sgt. W. B. BRIMELOW, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.

Sgt. A. CAWTHORNE, R.A.F., No. 467 (R.A.A.F.) Sqn.

Sgt. J. CLACK, R.A.F.V.R., No. 102 Sqn.

Sgt. (now P/O.) P. J. CORNWALL, R.A.A.F., No. 101 Sqn.

Sgt. D. CROMAR, R.A.F., No. 192 Sqn.

Sgt. H. P. CRUMPLIN, R.A.F.V.R., No. 467 (R.A.A.F.) Sqn.

Sgt. G. D. G. DAVIES, R.A.F.V.R., No. 101 Sqn.

Sgt. A. R DEARDEN, R.A.F.V.R., No. 61 Sqn.

Sgt. J. C. EARL, R.A.F.V.R., No. 101 Sqn.

Sgt. J. McG. FRECKLETON, R.A.F.V.R., No. 100 Sqn.

Sgt. L. J. FRYER, R.A.F.V.R., No. 101 Sqn.

Sgt. J. GERSHAW, R.A.F.V.R., No. 12 Sqn.

Sgt. G. F. GOWER, R.A.F.V.R., No. 97 Sqn.

Sgt. K. W. GRISDALE, R.A.F.V.R., No. 51 Sqn.

Sgt. W. A. HANCOCK, R.A.F.V.R., No. 101 Sqn.

Sgt. J. HANNA, R.A.F.V.R., No. 214 Sqn.

Sgt. J. M. HESP, R.A.F.V.R., No. 50 Sqn.

Sgt. L. G. HOLLAND, R.A.F.V.R., No. 51 Sqn.

Sgt. B. E. S. HOLSTE, R.A.F.V.R., No. 161 Sqn.

Sgt. F. G. HOMEWOOD, R.A.F.V.R., No. 61 Sqn.

Sgt. (now P/O.) F. S. HULLAND, R.A.F.V.R., No. 61 Sqn.

Sgt. A. JACKSON, R.A.F.V.R., No. 12 Sqn.

Sgt. E. JENNER, R.A.F.V.R., No. 161 Sqn.

Sgt. T. R. JONES, R.A.F.V.R., No. 97 Sqn.

Sgt. B. F. KERR, R.A.F.V.R., No. 166 Sqn.

Sgt. L. LAWRENCE, R.A.F.V.R., No. 61 Sqn.

Sgt. G. H. LOW, R.C.A.F., No. 419 (R.C.A.F.) Sqn.

Sgt. M. C. LOWE, R.A.F.V.R., No. 61 Sqn.

Sgt. J. E. MARCH, R.A.F., No. 138 Sqn.

Sgt. R. J. McDONALD, R.C.A.F., No. 101 Sqn.

Sgt. W. McINTOSH, R.A.F.V.R., No. 207 Sqn.

Sgt. R. McNAMARA, R.C.A.F., No. 427 (R.C.A.F.) Sqn.

Sgt. A. McVITIE, R.A.F.V.R., No. 158 Sqn.

Sgt. D. L. MEALING, R.A.F., No. 50 Sqn.

Sgt. R. PAYNE, R.A.F.V.R., No. 51 Sqn.

Sgt. J. E. PECKHAM, R.A.F.V.R., No. 12 Sqn.

Sgt. J. T. PRATT, R.A.F., No. 97 Sqn.

Sgt. S. ROBBINS, R.A.F.V.R., No. 466 Sqn.

Sgt. S. R. ROLFE, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.

Sgt. R. H. J. ROWE, R.A.F.V.R., No. 103 Sqn.

Sgt. (now P/O.) E. F. SCHMIDT, R.C.A.F., No. 10 Sqn.

Sgt. P. C. SCOTT, R.A.F., No. 207 Sqn.

Sgt. E. G. SHARPE, R.A.F.V.R., No. 192 Sqn.

Sgt. P. E. SHAW, R.A.F.V.R., No. 158 Sqn.

Sgt. T. H. SKEBO, R.C.A.F., No. 408 (R.C.A.F.) Sqn.

Sgt. E. G. SMITH, R.A.F.V.R., No. 61 Sqn.

SERVICE AVIATION

THE KING has been graciously pleased on the advice of Canadian Ministers, to approve the following awards:—

Air Force Cross

Wing Cdr. P. G. LAMB, A.A.F.
Wing Cdr. R. D. PEXTON, R.A.F.V.R.
Wing Cdr. J. G. TWIST, R.C.A.F.
Sqn. Ldr. E. A. BLAND, R.C.A.F.
Sqn. Ldr. G. A. FOLKINS, R.C.A.F.
Sqn. Ldr. C. A. JAMES, R.C.A.F.
Sqn. Ldr. J. U. A. MICHAUD, R.C.A.F.
Flt. Lt. J. E. PALMER, R.C.A.F.
Flt. Lt. A. F. A. UNDERHILL, R.A.F.O.
F/O. J. H. DEMPSTER, R.C.A.F.
W/O. 1st Cl. G. C. V. HUBREN, R.C.A.F.
W/O. 1st Cl. J. E. SHORT, R.C.A.F.

Award of a Foreign Decoration

THE KING has granted unrestricted permission for the wearing of the undermentioned decorations, conferred upon the personnel indicated, in recognition of valuable services rendered in connection with the war:—

Conferred by the President of the United States of America

Distinguished Flying Cross

Act. Wing Cdr. B. DRAKE, D.S.O., D.F.C., R.A.F.
Flt. Lt. R. J. PHILLIPS, D.S.O., R.A.F.V.R.
F/O. M. T. VANDERPUMP, R.N.Z.A.F.
Flt. Sgt. J. E. MILLER, R.N.Z.A.F.

Sgt. G. G. Whittle who has been awarded the D.F.M.

Roll of Honour

Casualty Communiqué No. 310.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 107 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. L. Green; F/O. J. A. Lerossignol; Sgt. A. D. Trotter; Sgt. I. Watters.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Cpl. J. Barnard; Sgt. V. F. Butcher; Sgt. A. G. Daniels; Sgt. W. H. Darge; Sgt. R. Laverty; Sgt. E. A. K. Nicholas; F/O. W. B. O'Connor; L.A/C. J. Savidge; Sgt. A. Staff; Flt. Sgt. L. J. Webber.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. S. Allen; Sgt. J. Bell; Sgt. N. R. Bennett; Flt. Sgt. A. E. Booth; Sgt. W. H. Bower; Sgt. R. D. Bradbury; Sgt. F. D. Buchwalter; Sgt. R. Calcutt; Flt. Sgt. C. Carr; Sgt. T. W. H. Casbolt; Sgt. C. W. Dickens; Flt. Sgt. T. I. Evans; Flt. Sgt. F. H. J. Farrell; Flt. Sgt. E. Froggart; Flt. Lt. P. D. Furniss; Sgt. A. F. Goff; Sgt. H. Jones; Sgt. J. R. J. Kau; F/O. F. W. Larcey; P/O. A. C. R. Laundon; Sgt. V. Lawrence; Sqn. Ldr. W. E. L. Lewis, A.F.C.; Sgt. W. G. S. McAsh; Sgt. H. McManus; Sgt. R. McNeill; Flt. Sgt. D. V. Marchand; Sgt. C. P. Mitchell; Sgt. J. Murchinson; Sgt. C. R. Pendelpho; Sgt. R. D. Perkins; Sgt. L. J. Preece; Sgt. N. Ridley; Sgt. C. Risingham; Flt. Sgt. R. M. Scratchley; F/O. L. A. Smith, D.F.C.; P/O. I. N. Stirton; P/O. W. D. Taylor; Sgt. H. Y. Torr; P/O. A. H. A. Treadwell; Flt. Sgt. A. W. Utting; Sgt. J. Warren; Sgt. T. A. West; F/O. I. R. Willis; Wing Cdr. V. C. Wood, A.F.C.; F/O. H. L. C. Woolley.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—F/O. R. G. Stringer.

WOUNDED OR INJURED IN ACTION.—Sgt. R. W. Dalkins.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. C. C. Gofton; Flt. Sgt. A. C. Harris; Sgt. D. W. Sweet.

MISSING.—P/O. A. P. Arnott; Sgt. M. Atkinson; Flt. Sgt. V. R. Baker; Sgt. T. Barnett; Sgt. E. Bartlett; Sgt. E. N. N. Beldon; Sgt. S. G. Bennett; Sgt. T. I. Betts; Flt. Sgt. E. W. Bower; Sgt. T. W. Bradford; Sgt. V. T. Bradley; Sgt. L. J. D. Bristow; Act. Wing Cdr. K. H. Burns, D.F.C.; Sgt. T. C. Cassidy; Flt. Sgt. R. C. Chislett; Sgt. H. N. Clarke; Sgt. J. Collins; Sgt. D. G. Connor; Sgt. A. Cowan; Sgt. G. D. Cox; Sgt. T. L. Craven; Sgt. J. Cunliffe; F/O. C. D. Farmer; Sgt. P. O. Fletcher; Sgt. L. Gaffee; Sgt. E. J. Gillman; Sgt. J. G. Golden; Sgt. T. Grange; Sgt. P. Groom; Sgt. R. C. Haigh; Sgt. J. Harding; Sgt. A. Harris; Sgt. J. Harris; Sgt. H. W. Heron; Sgt. J. C. Hick; Sgt. J. Hickling; Group Capt. F. S. Hodder; P/O. K. Holme; Sgt. S. H. Hopkins; Sgt. R. J. Humbles; Sgt. W. R. Huntley; Sgt. J. J. Jones; Sgt. J. Kenny; Act. Flt. Sgt. R. A. Knight; Act. W/O. O. Lambert; F/O. D. G. Leadeer Williams; Sgt. G. Lee; Sgt. F. J. Lucas; Sgt. W. C. McCartney; Sgt. E. McIntosh; P/O. H. W. Milligan; Sgt. T. G. Moore; P/O. C. E. Musto; Sgt. R. H. Nash; Sgt. R. G. Nelson; Sgt. J. W. Noble; Sgt. D. F. P. Pape; F/O. V. C. Peters; Sgt. J. Pollard; Sgt. A. A. Poulton; Sgt. G. J. Powell; Sgt. H. J. Pratt; Sgt. E. A. R. Preston; Sgt. L. A. Price; Sgt. F. G. Pryde; Sgt. O. Ramsden; Sgt. J. E. Rainsford; Sgt. D. B. Richardson; P/O. A. A. Robertson; Sgt. E. Robson; Flt. Sgt. H. Salter; F/O. R. R. Shadbolt, D.F.C.; Sgt. W. Sheffield; Sgt. H. Simister; Sgt. L. G. Smart; Sgt. J. Smith; Sgt. J. Snowden; Sgt. J. A. Stewart; Sgt. J. M. Stringfellow; Sqn. Ldr. A. C. L. A. Stuart; Sgt. J. Sutherst; Sgt. A. D. Taylor; P/O. A. E. Taylor; P/O. R. V. Turner; Sgt. F. W. Tysall; Sgt. L. J. Wakerell; Sgt. G. Wallace; P/O. K. Ward; F/O. O. J. Wells; Sgt. E. J. Wright; Sgt. D. G. Yardley; P/O. A. E. Young.

KILLED ON ACTIVE SERVICE.—Act. Sqn. Ldr. R. C. Dafforn; Sgt. M. P. De Sachy; Sgt. A. C. Dickenson; Sgt. E. J. Hitchcox; Sgt. J. H. Hutchinson; Sgt. F. Johnson; Sgt. E. R. Jones; Sgt. G. R. Joyce; Sgt. W. E. F. Lavender; Sgt. J. W. M. MacDonald; P/O. D. R. Moon; Sgt. F. W. Nixon; Sgt. H. Randall; Sgt. S. J. Richardson; Sgt. H. E. Rolfe; Sgt. A. W. Salt; Sgt. T. G. W. Shepherd; Sgt. S. A. Sims; F/O. J. B. Thomas; Sgt. G. H. Tough; Sgt. T. A. Walkden; Act. Flt. Lt. K. B. Watkins; Sgt. R. W. Woods.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. R. C. Evans; Flt. Lt. R. H. B. Field; Sgt. H. A. S. Fraser; Sgt. E. H. Johnson; Sgt. A. R. King.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—Cpl. L. A. Kearsley.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. T. L. Stephens.

DIED ON ACTIVE SERVICE.—L.A/C. D. K. Dorward; Flt. Lt. J. McCrory; A/C.1 A. A. Olney; Sgt. E. J. C. Stiles; L.A/C. F. H. Wood; L.A/C. G. E. Wootton.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. H. E. Cooper; Sgt. R. Cooper; Sgt. J. P. Egan; Flt. Sgt. F. J. Evans; Flt. Sgt. F. C. Fray; Sgt. G. Jones; P/O. S. G. Keatley, D.F.M.; L.A/C. H. W. Long; Sgt. F. J. Prothero; Sgt. J. S. Taylor; Sgt. G. C. Tisbury; Sgt. W. F. Turner.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/C.W.2 J. M. C. McDonald.

Royal Australian Air Force

MISSING.—Flt. Sgt. P. M. Brock; F/O. M. J. Campbell; Flt. Sgt. J. A. Chappell; P/O. F. C. Ebeling; Flt. Sgt. E. R. Galligan; Flt. Sgt. A. Hooker; Flt. Sgt. D. C. Houghton; Sgt. J. Lynch; Flt. Sgt. T. W. N. McGrath; P/O. K. J. Simpson; Flt. Sgt. O. J. Tanner.

KILLED ON ACTIVE SERVICE.—Sgt. R. J. Clifford; Flt. Sgt. K. G. Fitzgerald; F/O. R. T. Hood, D.F.M.; P/O. S. M. Johnston; Flt. Sgt. H. W. Rashbrook; Flt. Sgt. S. G. Richersey.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. F. B. Shaw.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. F. H. Barker; Sgt. W. D. Cameron; Sgt. C. O. Cook; F/O. E. W. Cunningham; Sgt. F. A. DeGruchy; Sgt. D. A. Ferguson; P/O. J. Fallis; F/O. T. M. Falls; P/O. H. F. Fansher; Sgt. R. C. Fenton; Sgt. C. B. Hodges; F/O. H. B. Kent; F/O. R. S. Kent; Flt. Sgt. J. Lawrence; Sgt. J. O. M. Lebel; Sgt. J. J. Lemke; Act. Flt. Lt. R. H. Lowe; Flt. Sgt. W. G. Murphy; Flt. Sgt. L. B. Murray; P/O. J. N. Peck; P/O. P. F. Pinder; Sgt. J. Richards; F/O. A. F. G. Ritch; Sgt. W. A. Rollings; Sgt. J. L. Sparling; P/O. C. Tuma; Sgt. W. W. Wallace.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. J. F. Smith.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. A. Albert; W/O. H. D'Aperng; P/O. E. G. Dolby, D.F.C.; Sgt. J. J. McLean.

SERVICE AVIATION

MISSING.—Flt. Sgt. C. G. Baker; Sgt. C. A. Davis; P/O. F. S. Green; Sgt. I. D. Jennings; Sgt. S. C. MacLennan; Flt. Sgt. J. D. MacNeill; Sgt. F. Middleton; Sgt. J. E. Milner; Sgt. G. A. Munro; Sgt. H. A. Queen; Sgt. T. J. Ryan; Sgt. H. K. Scott; P/O. G. P. C. Vandekerckhove, D.F.C.; Flt. Sgt. D. Zander.

KILLED ON ACTIVE SERVICE.—Sgt. W. J. R Blakely; F/O. C. Foderingham, D.F.C.; F/O. W. C. Gordon, D.F.C.; Flt. Sgt. H. R. Ross; F/O. A. W. Stewart, D.F.M.; Sgt. R. M. Todd.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—W/O. J. H. Clark.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. R. O. Leonard.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. A. Banks Martin.

MISSING, BELIEVED KILLED IN ACTION.—W/O. W. J. Vocasivich.

MISSING.—Flt. Sgt. J. G. Baker; F/O. J. Goulding; Flt. Sgt. D. L. C. Haub; F/O. D. C. Henley; Flt. Sgt. K. C. Jackson; Flt. Sgt. W. A. Kilby; F/O. J. B. Lovelock; Flt. Sgt. K. A. McGregor; Flt. Sgt. E. J. Roberts; F/O. E. I. Smallfield; Flt. Sgt. A. H. Smith; Flt. Sgt. I. H. R. Smith; F/O. O. K. Sutherland; F/O. C. A. Watson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. P. R. Karena.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. I. A. Mears.

Casualty Communiqué No. 311.

Of the names in this list 100 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. J. W. S. Anderson; Flt. Sgt. G. A. Bradshaw; Sgt. W. L. Clarke; Sgt. J. Cotton; F/O. B. E. Dye, D.F.M.; Sgt. R. B. Fletcher; Flt. Lt. J. M. J. Fryer; P/O. R. R. Gilbert; Sgt. J. P. Hague; Cpl. J. B. Kiernan; Sgt. A. J. King; Sgt. A. Lee; Sgt. A. E. Lester; P/O. E. Platt; F/O. F. N. Robertson; Sgt. C. M. Veale.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. F. H. Allen; F/O. R. Allin; Flt. Lt. A. Brindley; Sgt. J. Brown; Sgt. D. J. W. Buttery; Sgt. G. Cave; Sgt. D. O. C. Culshaw; Sgt. D. G. Davies; Sgt. L. Fox; Sgt. D. E. Hall; Sgt. W. Halsall; Sgt. K. Hands; F/O. W. J. Hart; Sgt. J. G. McAteer; Sgt. A. W. McMorrine; Sgt. J. H. Maudson; Flt. Sgt. G. B. C. Miller; F/O. C. E. Nicholson; Sgt. W. Noble; Sgt. S. P. H. Purchase; Sgt. C. E. Read; F/O. J. D. Robertson; Sgt. G. R. W. Ross; F/O. R. H. Stent; Sgt. C. Stubbs; Sgt. J. H. Surtees; F/O. J. C. Taffs; Sgt. G. Templeton; Sgt. F. T. Tolhurst; Wing Cdr. R. K. Wildey, D.F.C.; Sgt. D. J. Williams; Sgt. S. Young.

WOUNDED OR INJURED IN ACTION.—Sgt. V. J. Leach.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—W/O. P. Gatley.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. A. E. Belshaw; Sqn. Ldr. D. P. McKeown, A.F.C.; Sgt. A. J. Oakes; Sgt. A. W. Raggett; Sgt. J. Scott; Sgt. C. Walton.

MISSING.—Sgt. A. Bell; F/O. R. T. J. Bilney; Sgt. R. D. Binks; Sgt. P. Birch; Sgt. T. Birkby; Sgt. R. D. Botting; F/O. R. J. Boyd; Sgt. A. Burgess; Sgt. N. E. Burgess; Sgt. J. S. Carmichael; Sgt. G. Cheadle; Sgt. T. Collier; Sgt. A. Cotterell; Sgt. W. A. Crawford; Sgt. J. R. Dunn; Sgt. G. Ezard; Sgt. L. R. Fisher; Sgt. G. R. Ford; Sgt. P. G. Furlong; Sgt. W. F. Garner; Flt. Sgt. H. E. V. Gawler; Sgt. C. Golby; Sgt. H. E. Greavison; Sgt. R. F. Grove; Sgt. J. Hallsworth; Sgt. C. L. Hamilton; Flt. Sgt. J. S. Harries; P/O. E. C. Harrill; Sgt. E. B. Harvey; Act. Flt. Lt. J. R. Hastings; Sgt. J. W. Hayton; Flt. Sgt. A. V. Hefferon; F/O. P. E. Henley; Flt. Sgt. F. P. Hill; Sgt. R. J. H. Hitchmough; Sgt. L. Hobson; Sgt. O. H. Hodges; Flt. Sgt. W. P. Homersham; Sgt. D. Hopkins; Sgt. W. H. Horrigan; Sgt. O. H. T. Innocent; Sgt. R. V. G. Johnson; Sgt. J. G. Jones; Sgt. B. J. Kennell; Sgt. A. L. Kent; Sgt. A. L. King; Sgt. J. King; Sgt. P. W. Kitchen; Sgt. R. E. Langford; Flt. Sgt. S. C. Langston; Flt. Lt. D. C. Maltby; Sgt. W. C. Mitchell; P/O. H. A. Moore; Sgt. A. T. Newton; Sgt. T. F. Pearman; Sgt. D. E. Potts; Sgt. D. H. Reid; Sgt. L. S. Reynolds; Sgt. W. R. Rodgerson; Flt. Sgt. C. Salisbury; Sgt. A. F. Saunders; F/O. J. L. Shattock; Flt. Sgt. L. E. Short; Sgt. T. Silcock; W/O. D. A. Tucker; Act. Flt. Lt. C. E. Turner; F/O. V. P. Upton; Sgt. J. R. Wales; Sgt. S. G. Walke; Sgt. F. W. Watts; F/O. J. E. Watts; F/O. S. H. A. Woodhouse; Sgt. A. L. York.

KILLED ON ACTIVE SERVICE.—L.A/C. E. E. Elkington; A/C.1 A. J. Ferguson; Sgt. J. E. Garbutt; Sgt. F. D. Grehan; Sgt. P. Irwin; L.A/C. E. B. Jackson; Sgt. W. H. Lawrence; Sgt. F. E. L. Lungley; Sgt. D. Parsons; W/O. R. W. Pratt; F/O. A. E. Snell; F/O. R. L. Smith; L.A/C. P. L. Taylor.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. R. E. Burt; L.A/C. A. Richardson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—F/O. J. L. Hodgson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. H. R. Crompton; Flt. Sgt. D. E. Tymms.

DIED ON ACTIVE SERVICE.—A/C.2 R. W. Betts; Cpl. J. Campbell; Cpl. G. G. Dowson; Flt. Sgt. S. F. Foster; L.A/C. A. Hunt; Cpl. W. H. McCormick; A/C.1 A. M. S. McIntosh; L.A/C. D. T. Mansfield; L.A/C. E. R. Marsh; Flt. Sgt. L. E. Price; Cpl. J. H. Smith; Cpl. S. E. Woodhouse.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. M. P. Ellis; Sgt. F. S. Maltas; Flt. Sgt. E. A. Roede; Sgt. G. L. Stewart.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. E. H. Berry; Flt. Sgt. N. H. Fuss; Flt. Sgt. J. B. McLachlan; Flt. Sgt. M. J. Smart; Flt. Sgt. D. C. M. Walton.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. K. W. Paull.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. J. A. Frazer; Sgt. C. W. Musto.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. H. McDonald.

MISSING.—F/O. G. J. Bushell; Act. Flt. Lt. R. Carmichael; F/O. F. J. Clerke; F/O. C. R. Croft; P/O. J. S. K. Dalziel; Flt. Sgt. A. J. Davey; W/O. J. Gamble; Flt. Sgt. R. G. Harris; Flt. Sgt. R. J. Hunter; Flt. Sgt. E. T. L. Osborne; Flt. Sgt. G. F. Ritchie; Sgt. L. A. Saunders; Flt. Sgt. J. L. R. Stubbings; P/O. J. A. Tamsett; Flt. Sgt. K. J. Wilkes; Flt. Sgt. W. Yeomans.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. I. A. Eliot; Sgt. N. L. Wachter; Flt. Sgt. J. F. B. Wearne; F/O. C. W. Woods, D.F.M.; Flt. Sgt. G. L. Yensen.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. G. H. Taylor; Sgt. K. M. Wilson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. J. F. Allen.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. J. H. Smith.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. B. W. Agar; Flt. Sgt. A. W. Cochrane; Flt. Sgt. A. N. Connor; Flt. Sgt. G. Farah; P/O. A. L. Foster; F/O. D. C. Fraser; Flt. Sgt. I. C. Grice; Sgt. S. N. Hall; Flt. Sgt. J. H. Higgins; Sgt. V. R. D. Kissick; P/O. G. W. Lawry; F/O. P. J. Leboldus; Flt. Sgt. H. K. McGreery; Sgt. F. A. Maresa; Flt. Sgt. G. W. Miller; Sgt. T. E. Richardson; F/O. G. W. Sellers; Sgt. W. L. G. Thompson; Sgt. F. Ward; Flt. Sgt. R. Weiss.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. S. Archie; Sgt. A. E. Atkinson; Sgt. L. W. Bartman; Flt. Sgt. R. Birchall; F/O. J. H. Brown; Flt. Sgt. W. E. Cain; Sgt. A. C. Cantley; Flt. Sgt. H. H. Clements; Sgt. C. F. Daley; Sgt. L. L. Gladwin; Sgt. P. W. Gould; Sgt. D. I. Harvard; Sgt. C. D. Heming; Sgt. G. C. Heming; Flt. Sgt. R. W. G. Hogan; Flt. Sgt. W. J. Hogg; Sgt. S. J. Jorgensen; W/O. G. A. McMillan; Flt. Sgt. J. McA. Newton; Sgt. W. B. Nichol; Sgt. L. H. Peterson; P/O. F. Phosperine; Sgt. W. J. Reid; Flt. Sgt. R. Strong; Flt. Sgt. R. H. Ward; P/O. M. E. White, D.F.M.; Sgt. F. R. Windibank; Sgt. G. A. Young; Sgt. D. Zaleschuk.

WOUNDED OR INJURED IN ACTION.—Sgt. J. S. Boucher.

MISSING.—Sgt. R. E. Adam; F/O. R. E. Baker; Flt. Sgt. J. D. Bawden; W/O. P. P. Blazeiko; W/O. L. J. Burkitt; Sgt. J. Clark; Flt. Sgt. F. B. Davis; Act. Flt. Lt. J. L. Dehoux, D.F.C.; F/O. W. A. Gardiner; P/O. R. C. Gilbert; W/O. C. G. Glover; F/O. MacD. S. Gordon; Sqn. Ldr. F. E. Grant; Flt. Sgt. H. K. Kells; Sgt. R. Lesser; Sgt. C. C. Maw; Flt. Sgt. C. M. Niven; P/O. J. H. Price; Flt. Sgt. D. Scott; P/O. R. C. Sullivan.

KILLED ON ACTIVE SERVICE.—Sgt. E. C. Crabtree; Flt. Sgt. E. Harbo; F/O. W. F. M. Howard; Sgt. G. Morrow.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. H. Gilpin.

DIED ON ACTIVE SERVICE.—Sgt. K. I. J. Deane.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. E. Moorcroft.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. I. A. C. Grant; P/O. G. W. A. Mills; Sgt. N. P. Saul; Sgt. G. W. Sharman; P/O. E. B. Withell.

MISSING, BELIEVED KILLED IN ACTION.—P/O. R. H. Fitzgibbon.

MISSING.—Flt. Sgt. W. D. Clark; Flt. Sgt. R. W. Lower; Act. Flt. Lt. W. Y. McGregor; Flt. Sgt. V. T. Parkin; Flt. Sgt. T. Watters.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. R. G. Cotton; Flt. Sgt. F. Payne.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. N. J. Cheney; Flt. Sgt. D. C. Henderson; Flt. Sgt. L. C. Webster.

South African Air Force

MISSING, BELIEVED KILLED IN ACTION.—Capt. C. E. Martin.

MISSING.—Lt. H. F. Boyer.

KILLED ON ACTIVE SERVICE.—Capt. C. B. MacDonald; Lt. R. S. Meyer.

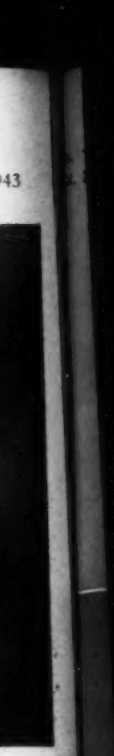
Official Corrections

Casualty Communiqué No. 309.

R.A.A.F.—Under MISSING delete Flt. Sgt. R. J. SINGER.

R.C.A.F.—Under MISSING delete Sgt. A. A. FREDERICKSON.

STILL DOING A GREAT JOB: An impressive picture of a de Havilland Tiger Moth. A variant of the first Moth produced in 1925 the beloved "Tiger" is still used in quantity for *ab initio* training.



Moth.
ed in

lie; Sgt.
. Sgt. R.
W. E.
H. H.
Gladwin;
Sgt. C. D.
R. W. G.
. Jorgen-
J. McA.
Peterson;
Flt. Sgt.
O. M. E.
Sgt. G. A.

Sgt. J. S.

E. Baker;
Blazeiko;
Sgt. F. H.
/O.; F/O.
/O. C. G.
Ldr. F. E.
R. Lesser;
P/O. J. B.
ullivan.
C. Crab-
. Howard;

SERVICE.—

J. Deane.
Now Re-
loorcroft.

Force

Now PRE-
C. Grant;
Sgt. G. W.

TION.—P/O.

Sgt. R. W.
; Flt. Sgt.

Sgt. R. G.

BELIEVED
PRESUMED
J. Cheney;
L. C. Web-

Force

TION.—Capt.

C. B. Mac-

AS

09.
Flt. Sgt.

Sgt. A. A.